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COMING SOON

The significance and measurement of the hydrogen-ion concentration in electroplating baths.

Protective films for metals from protein baths. Methods, uses, and evaluation of protective qualities.

Electropickling methods for descaling metals. A review of past research and present methods and trends.

Automatic polishing and buffing as practiced at one of the largest automotive plants.

Plating problems and operations of a large airlines plating shop for re-conditioning aircraft engines.

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Be Prepared

Along about this time of the year it would be wise for every finishing man to remember the above slogan made famous by the Boy Scouts, and begin to renew plans for combatting his perennial foe, Old Man Rust.

Soon we will be getting those warm, humid days that always promote favorable conditions for rusting of steel parts left unprotected around the shop, and what finishing man hasn't spent many an unhappy hour attempting to produce an acceptable finish on parts that have been carelessly treated (or untreated), resulting in rusted and pitted surfaces that require extra steps in cleaning or polishing before plating can proceed?

One of the principal sources of trouble often lies in the vapor degreasing operation used so frequently to remove dirt and chips from parts in process. The vapor degreasing does such a thorough job of removing all oils and greases that the parts are left in an ideal condition for rusting. Setting up an oiling or other rustproofing operation immediately after degreasing will result in tremendous savings in finishing costs in many cases. There are a number of good rustproofing materials available, ranging from heavy greases to dry, invisible films, and the rustproofing step should not be objectionable to subsequent operations if the correct type of film is chosen. When making a choice of rustproofing compounds, don't overlook the problem of complete removal for plating. Some types of materials offer excellent corrosion resistance but are very difficult to get off again.

Every shop supervisor realizes the advantages to be gained by a program for rust control, but it is up to the finishing man to keep pushing for it, as his department is the one most affected. While it is true that very efficient rust removers are also available, why spend time and money on the cure when the prevention is within reasonable attainment?



Modern Electroplating Laboratory for Development and Pilot-Plant Studies

By George Jernstedt, *Manager, Electroplating Projects, Westinghouse Electric Corp., East Pittsburgh, Pa.*

RAPID and efficient development of electroplating processes from beaker stage to 100-gallon tanks for pilot production operations is the intent around which every feature of a new electroplating laboratory has been built at Westinghouse. In a self-contained laboratory such as this, much of the time lag between the development and application of new processes should be eliminated. The processes will not be completely foolproof from the standpoint of commercial production but many commercial difficulties will be anticipated and eliminated by incorporating a pilot line as part of the development laboratory.

Special equipment and new procedures will be employed in this laboratory to produce large volumes of data on a production scale so development time will reduce still further. Analytical balances that project the correct weight of a sample immediately with no waiting period for balance swings or calculations; standard panels, polished, numbered and dated; completely wired plating tables and tanks; automatic timers to bring solutions up to temperature at pre-determined times; and many other time saving features have been employed.

Materials and designs are especially chosen for low maintenance costs. This not only provides an economical unit to operate, but the laboratory should also have a desirable appearance throughout the years to

come. Tile walls and tempered-glass bench tops are typical of the types of materials employed.

General Layout

The laboratory consists of an office, chemical laboratory, pilot room, service and storeroom, and an air conditioning and additional storage room. The total



The Author

area directly involved in the laboratory consists of 3300 sq. ft. The office is large enough to hold meetings and has ample bookcase space for books, literature, and patent files. In the chemical laboratory, work is to be carried out in the beaker and small tank size apparatus (4 gallon maximum). The pilot room is set up for plating actual production parts in sample quantities. Additional space is available in the pilot room for the installation of wire and strip lines later. The service and storeroom is designed so as to cover the preparation of samples by buffing or grinding; the preparation of plating racks; testing such as salt fog, cyclic humidity, and oven tests; paint spraying. It also includes a small workshop. Fine chemicals, glassware, heavy chemicals, and equipment are also stored in this room. A de-ionized water treating system is located in the air conditioning room. Space is also provided here for additional storage.

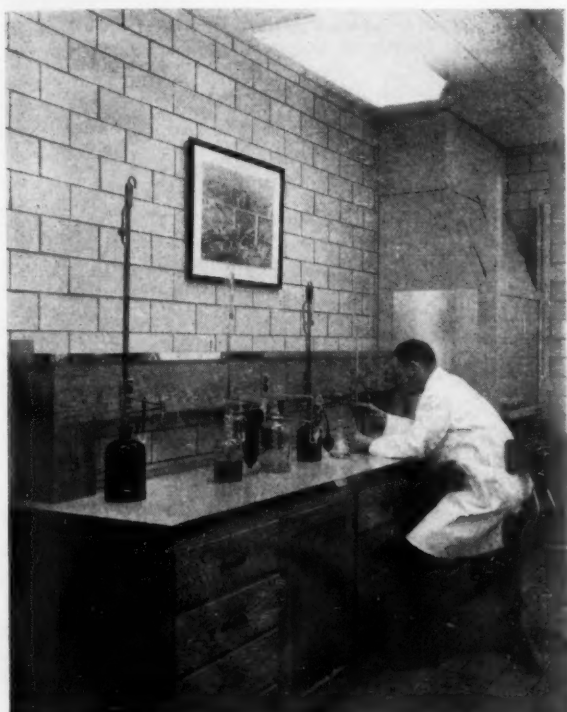


Figure 1. Speed in handling analytical work is increased through use of these semi-automatic burettes and pipettes.

General Construction

The walls throughout are constructed of a completely vitrified, non-staining, buff tile. All permanent wiring and piping is located behind these walls so that there are no pipes or wires visible except in the storage room where all piping and wiring comes to a central location. Floors are constructed of acid resisting, gray, non-skid tile containing carborundum. All materials throughout the laboratory are acid resisting. Ceilings are built with a sub-ceiling of a sound absorption material composed mainly of asbestos. Wherever paint is used on equipment such as tanks, exhaust system, office furniture, and motors, the color is standardized with one shade of gray acid-resisting paint employed throughout.



Figure 2. Although all wiring and piping are concealed they are readily available for maintenance.

Ventilating System

The main part of the ventilating system is a 25-ton Unitaire system with Precipitrons for air cleaning. The system cleans, cools or heats, and humidifies 9,000 cubic feet per minute. None of the air is recirculated. Three exhaust systems remove a total of 8,000 cubic feet per minute, and the remaining 1,000 cubic feet per minute is employed to maintain a slight pressure to keep the rooms clean. All windows and ceiling joints are sealed with caulking compound as additional insurance to maintain a clean laboratory, even in the industrial atmosphere of East Pittsburgh. Additional costs of the Precipitron and tile walls and floors should be recovered rapidly because of lower cleaning costs and more lasting construction.

Most of the laboratory is located beneath the main roof of the building. All air conditioning and exhaust ducts are run on the roof so that no space is consumed in the laboratory with unsightly duct work or ventilating system equipment. All the air is fed to the rooms through animostats, and the system is designed to maintain the temperature in the chemical laboratory at 25°C , $\pm 1^{\circ}$. This is done to facilitate the use of equipment, such as pH meters and to aid in the verification and duplication of laboratory data. Some cooling would be required in any event since the laboratory is located directly beneath a roof, and since such a large volume of outside air is being brought in constantly.

Chemical Laboratory

The entire chemical laboratory is furnished with standard units manufactured from first-grade, kiln-

dried oak as can be seen in Fig. 1. The finish on the units is light golden oak protected with a synthetic rubber lacquer and waxed. Wood is employed because of its great and lasting resistance to heavy chemicals. Tempered gray Carrara glass is used for bench tops because of its chemical resistance, presentable appearance, and ease of cleaning. Tempered glass has great resistance to mechanical shock. The only portion of the glass that is sensitive to mechanical shock is the edges, and extruded stainless steel edging prevents any direct mechanical shock at this point. As a further precaution, most of the pieces of glass on top of the benches were made of a standard size, 30" x 60", and spare pieces were ordered at the time of installation so that any breakage which might occur could be corrected immediately.

All piping and wiring is concealed and yet made readily accessible through the use of piping sections between the benches. The reagent shelves can be removed in sections from the top of the benches as shown in Fig. 2 and all wiring and piping made available for service.

The main plating areas are located in two center laboratory tables, the first of which is for beaker and Hull Cell work. The second table as seen in Fig. 3 is for four gallon tanks. These were picked because they are the smallest convenient size of tank where constant agitation and filtration, such as employed commercially, could be evaluated. In both benches, 10 ampere Variacs have been wired permanently for securing fine adjustments for immersion heaters and agitator motors. Resistors, ammeters, and switches have also been permanently connected so that only two wires to any tank will give a complete setup with maximum speed and flexibility. There are four plating stations on the beaker-size table and eighteen plating stations on the small tank-size table. Preliminary operation of these units indicates that this apparatus plus various other pieces of equipment, such as automatic burettes and balances make possible the production of many more sample plates per man day than is possible with other arrangements and equipment.



Figure 3. Four-gallon tanks set flush in the electroplating development tables permit constant agitation and filtration when necessary. Remote control valves and switches can be seen on the vertical panel.

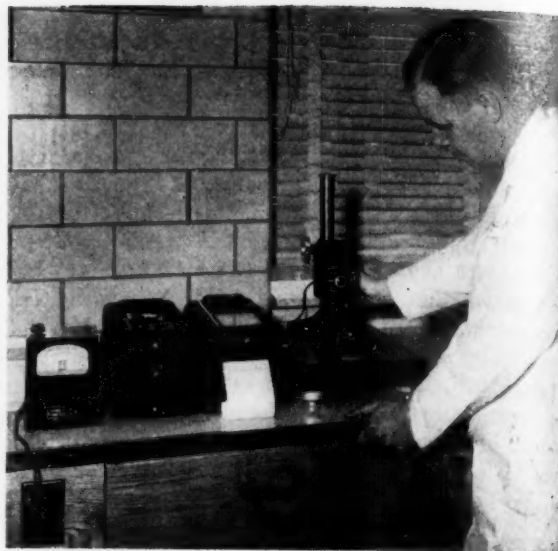


Figure 4. Surface roughness can be measured on this Brush Surface Analyzer capable of magnifications up to 40,000 diameters.

The small-tank plating unit has 12-foot drainage troughs on both sides so that all overflow and drippage automatically is washed to the sewer. The tanks are sunken in the benches and are flush with the glass tops. Standard laboratory units are used for the main construction. A stainless-steel deep-basin sink is located at the end of each plating unit. Sliding doors have been used wherever possible in the cabinets so as to keep the aisles clear and the laboratory looking tidy.

A projection-type analytical balance serves to expedite the weighing of test panels by eliminating the necessity of taking readings of the swinging arm in an analytical balance. No weights are employed below one gram. The weight of the panel or other material is indicated directly by projection on a ground glass to ± 0.1 milligram. This is not quite as accurate as the standard chemical analytical balance; however, since time is an important factor and accuracy is ample for the work involved, this balance has been found very useful.

The chemical laboratory is equipped with many pieces of apparatus to expedite the work such as the Brush Surface Analyzer seen in Fig. 4 that magnifies roughness 40,000 times, the Brenner Magne-Gage to determine thickness of plated coatings, various microscopes and camera attachments, pH meters, and automatic burettes. Current supply for the two plating tables consists of two 200-ampere selenium rectifiers with voltage regulators for providing constant voltage from 0- to 100-percent load with a maximum variation of plus or minus one and one-half percent.

Pilot Room

The main line in the pilot room seen in Fig. 5 consists of nine 100-gallon tanks. Most of these tanks are rubber lined. The chromic acid tank is lined with a synthetic vinylite composition that has been used commercially for chrome plating tanks up to temperatures of 140 degrees F. An insulated tank of this sort should have distinct advantages over the old-type lead lined tanks. All of the tanks that are heated with

steam are controlled with solenoid valves and Sarco Regulators. These regulators are controlled by one timer on the main control board. It is possible to have the timer turn on the steam valve at any time during the night and bring the tanks up to temperature by the first thing in the morning so that no time is lost in waiting for an experimental tank to be ready to operate. Ceramic crocks have been installed in some of the tanks so that they will serve not only as acid-dip tanks but water-rinse tanks as well. In addition, other water rinse tanks have holders installed so that two or four 4-gallon plating tanks from the chemical laboratory can be employed as strike or dip tanks as shown in Fig. 6. Anode and cathode rods, crocks, tanks, etc., have been mounted beneath the upper flange of the tanks so that any tank can be completely covered with a single flat piece of transite. This maintains a clean solution and keeps it from evaporating when not in use. The transite tops also serve well as additional desk top space.

All pipes, wiring, valves, and resistors have been concealed in the pilot room as well as in the chemical laboratory but are available for easy maintenance. Between each group of three tanks a service space is located in which is mounted the resistors, switches, and controls. A sliding stainless steel cover joins each group of three tanks to provide additional desk top space and, at the same time, gives the pilot room a streamlined look. The pilot line is situated three feet from the wall as can be seen in Fig. 7 so as to provide a service aisle for maintenance of all bus bars, steam lines, water lines, and electrical lines. Each tank is connected, or can be connected, directly to a 3" Duriron sewer line. It is hoped that this will prevent liquids from being slopped on the pilot room floor, and keep it clean.

Each plating tank is completely equipped with instruments, resistors, and switches occupying a minimum of space. The biggest space consumer would have been 200-ampere double-pole, double-throw knife switches. At least one, and sometimes two, would have been necessary for each tank. By joining together two single-pole, double-throw airplane switches

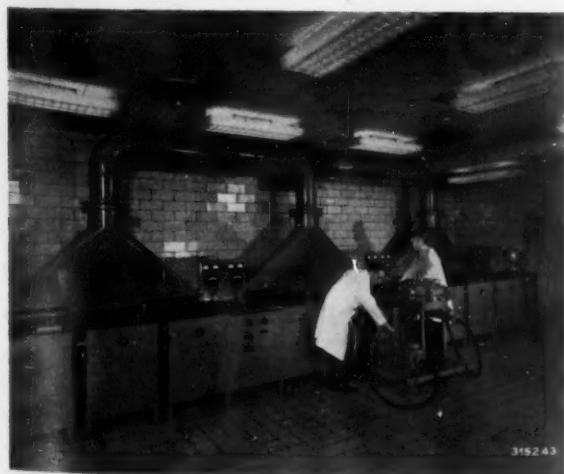


Figure 5. These 100-gallon tanks are large enough for pilot-plant experimental production. Piping and controls are located between tanks.



Figure 6. Two strike tanks have been added to one of the 100-gallon rinse tanks for greater flexibility.

developed for low-voltage, high current work it is possible to mount all the switches required in two panels between the tanks. In addition to the advantage of size, these switches are totally enclosed and have silver plated contacts.

Carbon resistors are used for control over the wide range of currents required for these plating tanks that would otherwise have required unusually large resistor boards. It is recognized that carbon resistor values change with temperature but this is a minor factor in comparison with the advantages of small size and wide latitude in current adjustment. De-ionized water is piped to each group of three tanks and is employed in all solution makeup as well as in some rinsing. The pilot line is equipped with two 600-gallon-per-hour rubber-lined and Duriron-equipped filter pumps. High speed solution agitating equipment is also available for two of the plating tanks. A panel board at the end of the pilot line contains the controls for the motor generator, various reversing apparatus, timers, agitation equipment, and the Precipitron unit. All piping and wiring comes to the pilot room at one end of the room. A piping duct is provided in the wall so that all pipes and wires in both the pilot room and the chemical laboratory are concealed but can be maintained or changed as required. Additional space is provided for future expansion.

Service Room

The service room is divided into two sections. The first contains sliding-door, oak cabinets for fine chemicals and glassware storage. A complete line of chemicals and miscellaneous laboratory equipment is available. Large storage shelves are also provided in this section for heavy chemicals and large apparatus. A stock of raw materials such as rack coatings, sheet rubber, copper and lead wire, and other miscellaneous raw materials is also maintained. This section also contains a large tool chest, a drill press and vise, and work bench.

The second section of this space seen in Fig. 8 contains the various pieces of service equipment. A 16-cubic foot cyclic, stainless-steel steam chest is used for corrosion testing of finishes for the tropics. A large-size salt-fog apparatus is also available for corrosion testing. Both cyclic steam chest and salt fog units are connected to the de-ionized water system, the city water system and to the sewer. These connections are made permanent to facilitate the cleaning and operation of these cabinets. A 14-inch, double, adjustable-speed, buffing lathe and a double-end grinder are also located in this section.

The current supply for both the chemical laboratory and the pilot room is located in this section and consists of a 1000-ampere motor-generator set with 1000-ampere contactors to reverse the current if re-



Figure 7. A service aisle behind the pilot line makes easy maintenance possible.

quired. Later a 2000-ampere selenium rectifier with voltage regulation will also be installed in this space.

A paint-spray booth, high-temperature furnace, circulating oven, and service sink complete the equipment in this area.

Air Conditioning Room

The 1000 gallon-per-hour de-ionizer unit is located in the air conditioning room. De-ionized water is piped from this unit to all tanks, sinks, and hoods. Regenerating crocks are permanently connected to the unit so that the tanks can be regenerated with a minimum of effort. There is no distilled water available in the laboratory since it is felt that de-ionized water is more than satisfactory for this type of development work. The air conditioning room is used as additional storage space for such items as utility truck and acid-bottle crates.

Sample Panels

One important item on which a great deal of work

was spent was the standard test panel. This was done to reduce the time expended in handling and preparing panels for test. The optimum size of panel was determined to be one-tenth of a square foot, or approximately 2 inches by 4 inches as shown in Fig. 9.



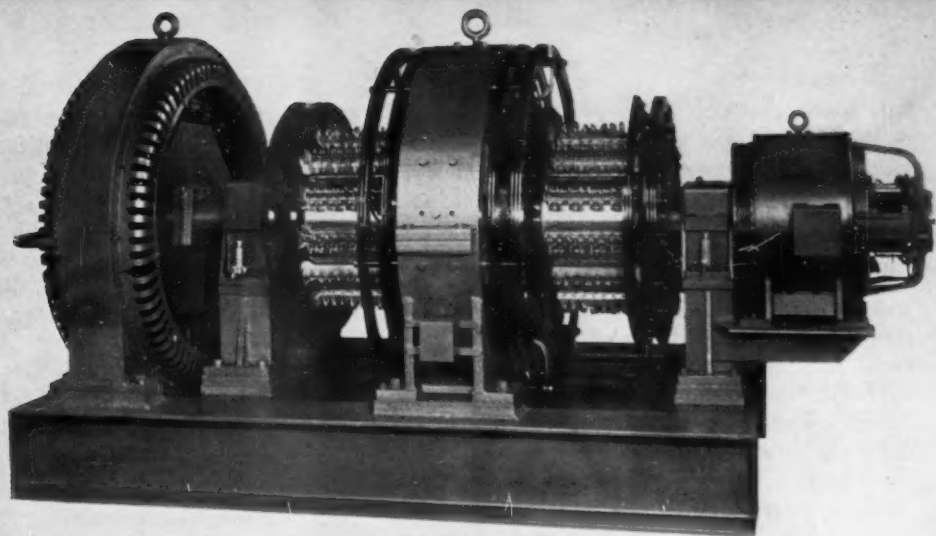
Figure 8. Buffing, grinding, and atmospheric corrosion testing equipment is located in the service room.

All data taken from an ammeter merely requires the change of a decimal point to give the reading in amperes per square foot which is the standard of the industry. These panels have been designed so as to be suitable for the Hull Cell test which is very useful in development work. Further, the panels have been prepared from the standard appliance steel and brass so that data may be more readily interpreted in the manufacture of appliances. The panels have been stamped with the department name, a place for the date, and are numbered consecutively. Cellophane envelopes and boxes have been made for storage so



Figure 9. Standard experimental panels are sized for convenience in development stages from Hull cell to pilot tank. Here a panel is being filed.

the panels will be readily accessible at any later date. Panels prepared in this fashion are more readily recognized by the Patent Office, since they are issued to the individual and form a continuous pattern in the engineers figuring book. Many thousands of these panels in both brass and steel have been secured, and it is felt they will expedite development work.



Modern Plating Generators

By Gordon J. Berry, Vice President, The Electric Products Company

THE electroplating industry has made great strides since the early days when the plater adapted existing equipment to his needs, and then put the work in the tank with a hope and a prayer that it would turn out satisfactory.

We in the industry today owe a great debt to these pioneers who, in spite of their crude equipment, proved the value of electroplating. Today the industry is composed of many individuals; in addition to the actual platers, there are manufacturers of tanks and racks, manufacturers of plating power supplies, manufacturers of supplies and solutions, and the distributors who handle these lines.

It would be a lengthy chore to list all pieces of equipment now found in a plating shop, but the fundamental equipment is still the tank and the power supply. Solutions, racks, and all the sundry items are of no value without a dependable source of power, for therein lies the ability of the solution to accomplish the plating for which it was compounded.

This statement is not made to disparage the part performed by any one of the myriad items found in a modern plating shop. Each of these devices is designed for a specific purpose, and the job of doing quality plating. But the fact remains that the power supply is the very heart of the whole electroplating industry.

Establishing the importance of a reliable and dependable power supply raises the question as to what conditions should be investigated when purchasing a new motor-generator set. In order to do the job required, a power source of sufficient voltage and amperage must be chosen. So, the first consideration

is, naturally, what type of work is to be done. This will determine whether a 6, 12, or 40-volt machine, or some voltage rating in between should be secured. The second consideration should be the amount or volume of work to be handled. This, of course, will be determined partially by the size of tank available. If work requiring 50 amperes per piece is contemplated, and only 10 pieces will fit in the tank, a generator of 500-ampere capacity is satisfactory. But the modern plating man also thinks of the future, so it might be advisable to purchase a larger generator.

Each application should be weighed and analyzed individually, considering:

- 1—Voltage required.
- 2—Current required at present.
- 3—Current required in immediate future.
- 4—If additional current will be required, is it satisfactory to supply it from one generator, or would an additional generator and tank be more acceptable.

The same considerations exist in an established plant contemplating replacement of equipment. The condition of the power source must be checked regularly, and this check-up will tell whether or not its efficiency is sufficient to warrant keeping it. No plater can afford to operate outdated and inefficient equipment.

For some reason, the plating industry has lagged behind others in modernization plans. This may be partially the fault of the producers of equipment who in many instances have failed to develop new methods and techniques. Other industries have been ever alert to replace equipment with more modern and efficient

machinery. Take the machine shop as an example. In the old days, a central power source was established to drive all their machinery from an overhead belt-and-drive arrangement. When motors became available to run individual machines, these shops quickly converted to this more modern and efficient method of operation. Even though the central power plant was still in good operating condition, the machine shop discarded it in favor of the better method, because they could not afford the inefficiency of this outdated equipment. Machine tools are constantly being replaced with more modern ones so that the most efficient method will be available. The prime consideration is always whether the net cost of operation can be reduced by new equipment.

A survey has been made in the electroplating industry, which disclosed that even though some of the plating equipment was replaced with newer and better equipment, almost invariably the power supply was left untouched. This is perhaps a tribute to the ruggedness of the equipment made by motor-generator manufacturers, but it is poor business acumen when a new motor-generator will result in production savings.

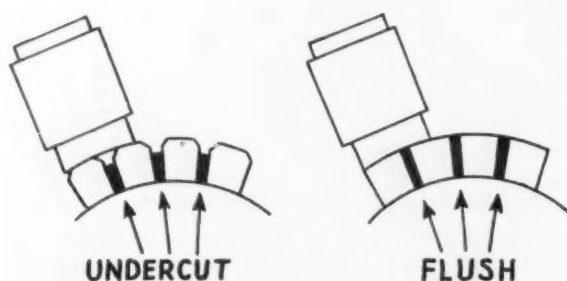


Fig. 1—Illustrating the reasons for under-cutting mica insulation.

Part of the cost of any business is the amount of money necessary to replace equipment. Our survey disclosed that although most plating shops set up a reserve for depreciation (which takes care of the wearing out of the machinery), few considered the cost of obsolescence, which is the cost of replacing machinery which has become obsolete due to the development of better and more efficient equipment.

The electroplating industry has been through good and bad times. Since it is a service industry, its business is dependent upon the success of their users' business. Experience proves that in the electroplating industry there is either a "feast or a famine." When the "feast" period is upon us, we need the most modern and efficient equipment available, so as to take all possible advantage of the good times, thereby setting aside money for the poorer times. Furthermore, during the exceptionally good times we can't close down to replace obsolete equipment, and if we depend upon expansion we find the lush period has passed before we could liquidate the expense of expansion.

If modern equipment is important during good times, it is doubly so during the period of "famine". The electroplating industry is highly competitive, and the cost of plating is extremely important. Many times the profit per piece plated is a small fraction of a cent,

so unless the power source is most dependable and efficient, you cannot compete during the slow periods.

We have passed through the war period when equipment was overworked, and, because cost was unimportant, outdated equipment was used. Many of the plants surveyed had motor-generators over 20 years old. As stated before, this may be a tribute to the equipment, but it certainly hasn't reduced production costs.

In a typical survey recently made, the customer had a number of power sources, of various voltages, totaling 200 KW d-c. The modern motor-generator sold for this application resulted in a saving of \$6,805 per year, which completely pays for the new equipment in less than 5 years.

In considering a modernization program, what specific requirements should be considered?

We must first, of course, determine the voltage and amperage required for the plant. Then considerable thought should be given to the individual installation. What space is available? The floor area must be of sufficient size to accommodate the equipment. What location is available? If a location far from the plating tanks is chosen, the bus installation will be more costly. Perhaps two locations are available with a generator for each. Or perhaps several generators should be provided, each to carry its share of the total required capacity directly to an individual tank.

What does the first cost, or initial investment, of the equipment include? Is one manufacturer's price cheaper because his equipment doesn't include all that the other's does?

Is installation cost a factor? Does the increased installation cost of several motor-generators justify their purchase over a single motor-generator? In general, if the business is spotty and relatively few tanks are operated each day, the added efficiency gained by operating at nearer full load, of operating one generator to one tank, will offset the extra installation cost.

What about efficiency? If a new motor-generator will operate at a higher efficiency than the old one, your present cost per plating job is too high, and newer equipment would be more economical.

The dependable performance of a motor-generator over varying load conditions and years of service is important. Does the equipment proposed have experience behind it to satisfy you that it will operate satisfactorily with a minimum of maintenance for an extended period? Today's high labor cost makes it essential that maximum usage of equipment is obtained.

So many questions arise that it becomes burdensome for the plating man to correctly evaluate all factors. He is an expert and an authority on the plating process, but he can't be expected to know the features and characteristics of all items of equipment. For this reason, the modern plater should call in a qualified distributor who has an excellent knowledge of all the equipment used in a plating shop, and in addition, has access to the engineering departments of the manufacturers of component pieces of equipment.

The old plating shop was a hodge-podge of equipment. Each item was purchased individually as the

occasion arose. Contrast this with the modern plating plant which is designed by a distributor of equipment who coordinates and integrates all the pieces of equipment into a uniform installation so that the flow of material follows a prearranged plan, and the plating is accomplished with the maximum ease and efficiency.

Motor-Generator Principles

In 1831 Faraday discovered that a copper disc rotating between the poles of a magnet would produce an electrical current. Although this machine was of little practical value, because of the minute current developed, it is the same principle that is still used to generate electricity, even in the commercial power houses.

Through the years, improvements were made on Faraday's original machine so that greater and greater output could be obtained. Since a generator, or dynamo as it is referred to in power houses, converts mechanical to electrical energy, there must be some method of completing an electrical circuit to the rotating armature of a generator.

This is accomplished by bringing the armature wires to a commutator, which revolves with the armature. Conductors, called brushes, are then held in position so that the copper bars of the commutator make contact with the brushes as they (copper bars) rotate. In other words, the conductors brush over the commutator.

Since it is fundamental that all material resists the flow of an electrical current, it is apparent that this resistance takes place within the generator itself, as well as throughout the external circuit. This is one of the reasons that power-house dynamos usually generate electrical energy at 2300 volts for transmission, as this high "driving" voltage overcomes internal and external resistances and reduces transmission losses to a minimum.

The history of electroplating closely follows the development of the generator. In fact, the principle of electroplating was discovered in the early 1800's. But at that time the only suitable power source was the galvanic, and later, the voltaic cell. Both of these cells were expendable, and were of a very low capacity. Consequently, they were of little practical use for commercial electroplating. The development of electroplating was therefore retarded until the development of a more dependable and efficient power source was made.

The generator's development appeared to supply the necessary power source for electroplating, but, of course, the power-house dynamo was of too high a voltage to be practical. Secondly, as power transmission was developed, the electrical energy was generated as alternating current, whereas only direct current was suitable for electroplating. Since the principle of the generator was fundamental, it appeared that it was only necessary to construct a generator of the proper voltage and amperage output to utilize it for electroplating. This theory was sound, but because of mechanical problems involved in generating low-voltage current, the early electroplating generators were unsatisfactory.

The voltage drop, which is fundamental to an electrical circuit, became an obstacle in low-voltage generators. A drop of a volt or two in a high-voltage dynamo had little effect upon the distribution of electricity from the power house. But a volt or more drop when dealing with six or less volts was disproportionate to the output of a plating generator.

History of Generators

The early generators for electroplating used a gauze brush, which was actually made up of layers of woven copper wire. These brushes were held in position on the commutator, but the contact made was very unstable with the resulting poor operation of the generator.

At this time during the history of the electroplating industry, the generators were bulky, heavy and un-

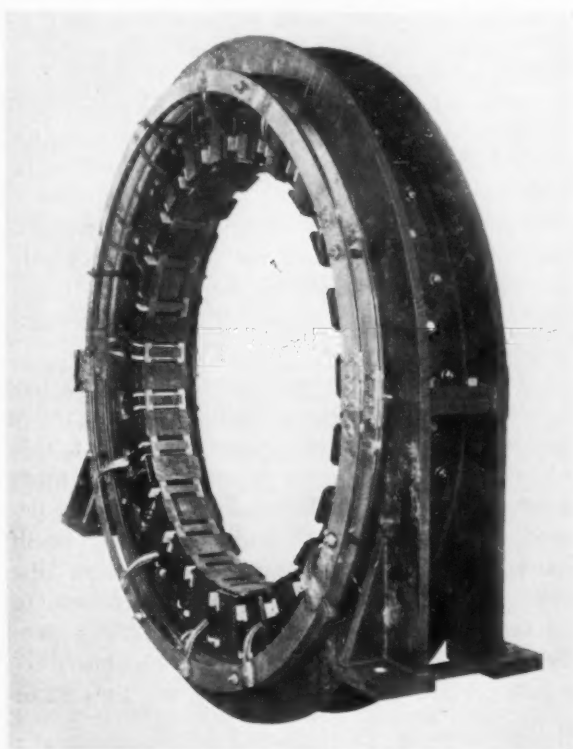


Fig. 2—Rolled copper collecting rings reduces bulk and increases efficiency.

stable. We were at a period in our history when apparently weight and size meant superior machinery. Floor area was inexpensive so there was no need to conserve space. It wasn't until later years when economics demanded smaller size that we discovered we frequently gained in operating efficiency by decreasing the mass of material. This is no reflection on the early generators, because, if the facts are faced, we discover that the whole electroplating industry was in a rather crude and unskilled state. There just wasn't enough business to warrant the development of generators for this specific application. We have found through experience that better performance of any equipment is secured when that equipment is designed for the specific use to which it is put.

However, the industry was destined to enter the realms of "big business". We find the first indication

of this in the second decade of this century when solutions were perfected to a higher degree and the greater applications of electroplating became apparent. Plated jewelry, at a price the working man could afford, matched in appearance the expensive jewelry only available previously to the wealthy. Plated silverware was found to approach the wearing qualities of expensive sterling ware. Plated surfaces exposed to the weather were found to outlast unplated metal.

This expansion within the industry attracted more highly skilled help. The more highly skilled help demanded better equipment, which in turn attracted more specialized suppliers. These suppliers demanded more specialized equipment from their manufacturers, who then had sufficient potential volume to warrant the expenditure of their engineers' time to develop better equipment.

The greatest impetus to the plating industry was the automobile, which demanded such a quantity of quality plating that the industry would have improved from this source alone. With the assembly line production of the automotive industry, it was no longer possible to depend upon an unreliable plating shop, because schedules had to be met, and quality had to be maintained.

The automotive industry brought the plating industry out of the back alley, and established it as a highly respected business. The plating shop had to be better managed with specialists capable of solving the myriad problems that arose.

In the mid 1920's, the motor-generator manufacturers met the challenge by producing the first really dependable, heavy-duty, low-voltage power plant. This motor-generator was a great improvement over those previously sold to the industry. They were better designed, ran at a slower speed, and had improved brush contact. These improvements resulted in longer life, greater efficiency and much more stable operation. However, in spite of the improvements, there were still some undesirable features which the industry set about to correct. The results obtained are a generator



Fig. 3—Equalizers on commutator bars promote better fan-cooling action.



Fig. 4—Welded steel frame results in greater strength with less weight.

offered to the trade today that is superior than at any previous period.

Even with the high quality of the present motor-generator sets, improvements will not cease. The industry is constantly alert to the platers' needs, and is continually endeavoring to better the product offered the trade. But the plater who is using a power plant that is not of the last few years manufacture, could probably improve his efficiency and quality by replacing his power plant with a modern one.

Design of Modern Generators

The modern generator should have the following features:

UNDERCUT MICA

One of the difficulties with low-voltage generators was the inability of the brushes to last an appreciable time. The mica that is used as insulation between the commutator bars is harder than copper, so it did not wear down as rapidly as the commutator bars. As soon as the mica was at a higher point than the copper it would then start wearing the brush, because it was also harder than the brush material. If this wearing were the only problem involved it would not have been too serious, but as the mica became higher than the copper the intimate contact between the brush and copper was destroyed. This caused sparking, which in turn caused further wear to the brush, and, worst of all, caused a voltage drop with a resulting unstable operation of the generator.

Undercutting the mica is expensive from the manufacturer's standpoint, because, in addition to the actual expense of undercutting, there is the added expense of requiring a perfectly balanced and symmetrical

commutator. However, the results are well worth the additional expense, since with an undercut commutator there is more intimate contact between the brush and the commutator. This results in longer life to both the brushes and the commutator, and 2% higher efficiency is obtained. Figure 1.

ROLLED, HARD-DRAWN COPPER COLLECTOR RINGS

For years the industry had used cast brass collector rings, which have a current carrying capacity of 200 amperes per square inch of perfect casting. Since blow holes do develop in castings, it was the practice to increase the cross section diameter of the brass in order to be sure there was at least one square inch of brass per each 200 amperes output. While this practice theoretically overcame this difficulty, it resulted in a waste of material and a bulky construction.

The solution to this problem was to roll hard-drawn copper for the collector rings. This accomplished a more uniform appearing and better operating generator, with considerably less bulk. Since the hard-drawn copper is solid material with no blow holes, it is unnecessary to provide more material than needed. And since copper will carry 1000 amperes per square inch, a great savings in bulk resulted.

As there is no waste of material when using hard-drawn copper, the collector rings can be rolled to the size of the frame diameter. This allows an unrestricted path for the flow of air into the generator frame, and, most important, makes the internal parts of the generator more accessible for inspection or repair. See Figure 2.

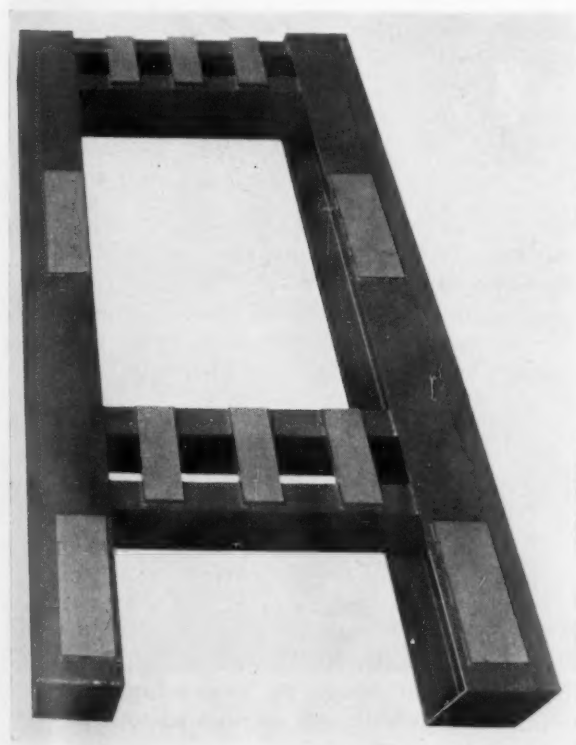


Fig. 5—Welded steel base replaces heavier, less dependable cast iron.

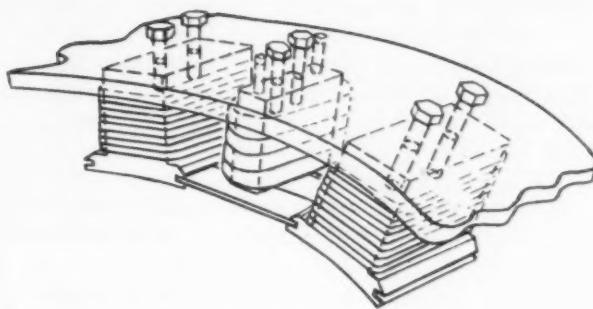


Fig. 6—Showing method used to obtain equalized pole spacing, with adjustable depth of interpoles.

COMMUTATOR BAR EQUALIZERS

To aid commutation, every commutator bar should be equalized. These equalizers are preferably made of strap copper, and should be sturdy and self-supporting. In addition to aiding commutation, a fan cooling action is obtained by the mechanical rotation of the equalizers. Figure 3.

REPLACEMENT OF CAST IRON WITH STEEL

Experience derived from changing the collector rings from castings indicated that the cast-iron frame itself could be changed. The same blow-holes develop in cast-iron, requiring an excessive amount of material, and in the generator frame, the blow-hole would distort the magnetic flux which would result in an unstable characteristic. Steel will carry $2\frac{1}{2}$ times as much flux as cast iron, so the solution was rolled-steel frames. This results in greater stability, a decrease in size and weight, and a more uniform and pleasing appearance. Figure 4.

While the cast iron bed-plate has no particular importance to the electrical characteristics of the generator, it does have the distinct disadvantage of bulk, weight, and questionable strength. Castings are less favorable than steel bed-plates. Figure 5.

Here again the cast pedestal does not affect the electrical characteristics, but size, weight and strength are improved by constructing these of steel.

A cast-iron armature spider had always been used in earlier generators. This was bulky, heavy and of questionable strength. By changing from this to a welded steel spider, all these questionable features are overcome. And, most important, it opens up the center of the armature to allow greater air cooling, and increases the stiffness of the shaft.

For the same reasons, and with the same results, steel is more desirable than iron castings in the synchronous motor frame, stator end-plate and rotor spiders.

POLE SPACERS AND ADJUSTABLE INTERPOLES

One of the most troublesome problems electrically with generators was the fact that due to necessary clearances in the frame hole drillings, the main and interpoles were never exactly spaced evenly around the periphery of the armature. This resulted in unbalanced armature currents, which in turn gave an unstable characteristic to the generator.

The solution to this problem is simple, yet ingeni-

ous. It is based on micrometer machined pole spacers which fit into a slot on the main poles. This accomplishes exact spacing of the main poles, and, with additional slots, exact spacing of the interpoles. This precise main and interpole spacing results in more uniform operation of the generator.

The exact spacing of the poles permits the solution of the second most troublesome electrical problem. In the conventional generator having 5 commutator bars per pole, which is standard, seven turns of wire on the interpole is too few, and eight turns is too many. Since the wire entered from the rear of the interpole and leaves at the front, it is impossible to make less than one complete turn.

However, since this interpole is now accurately spaced, and held at the end nearest the armature, it can be raised or lowered by a system of set screws, which will increase or decrease its flux to the armature. So, as long as the number of turns on the interpole is practically correct, the interpole can be adjusted to give the desired magnetic flux, and thereby obtain more stable characteristics from the generator. Figure 6 illustrates these methods of construction.

OPEN-TYPE BRUSH HOLDERS

The collector bus structure for the brushes, and the brush holders themselves were previously supported on a ring directly over the center of the commutator. With that construction it was difficult to inspect and change brushes.

To overcome this objection a brush holder was developed supported from one end only. This type of brush holder is of sturdy, bridge-like construction, assuring vibrationless contact for the brushes; it is adjustable, so as to follow the commutator wear; it has individual replaceable fingers and springs. Because of the angle of the brush to the commutator, together with the direction of spring pressure, positive contact of the brush with the commutator is assured, and complete adjustment, regardless of wear and corrosion is obtained. Figure 7.

An unexpected dividend is secured by opening up the commutator section. The temperature of the generator dropped from about 40°C. to 28°C. because better air cooling was obtained.

BEARINGS

A number of years ago, the University of Wisconsin

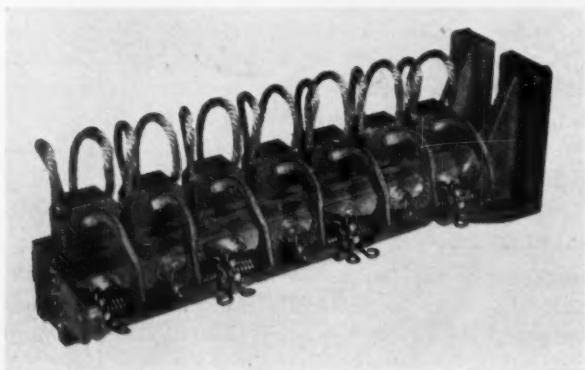


Fig. 7—One piece brush holder construction affords easy adjustment and maintenance.

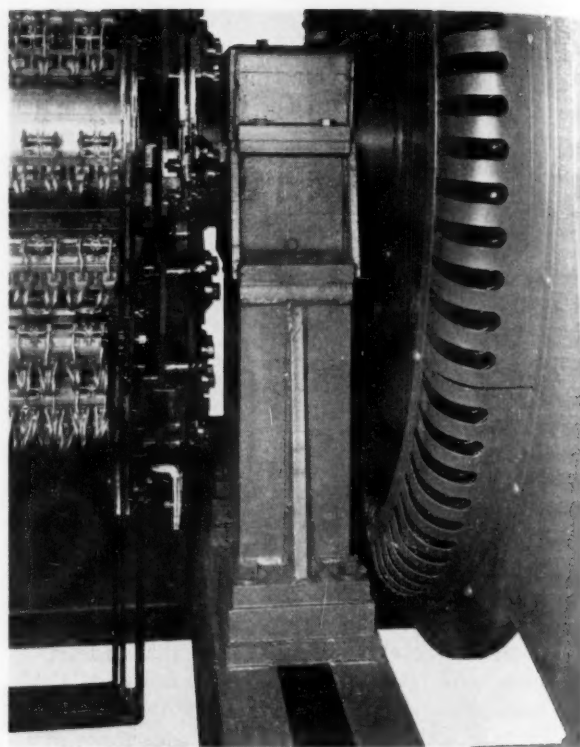


Fig. 8—One-to-one type of bearing for reduced friction loss.

was endowed to study the subject of bearings. After much study and countless calculations they concluded that the old standard 2½-to-1 bearing was definitely wrong with our present-day bearing metals, and recommended a 1-to-1 ratio. This ratio is based on the relationship between the length and diameter of the bearing.

With a bearing no longer than its diameter, there is a reduction over the old method of 40% in length and 40% in friction or rubbing area. In actual test the 1-to-1 bearing has a temperature rise of only 11°C. as contrasted to an average temperature rise of 40°C. for the 2½-to-1 bearing. Figure 8.

INSULATION

In an application such as encountered in a plating shop there are two factors that affect the life of the insulation used in the generator wiring . . . heat and corrosive fumes. Much has been done in the past 20 years to improve the insulation so as to withstand these two factors. By better ventilation of the generator, much has been accomplished in reducing the loss of insulation from heat.

The effect of corrosive fumes has been minimized by a system of impregnated coils and armature windings in a corrosion-resistant substance, which in itself is an insulator, and at the same time is a protection for the existing insulation.

General Remarks

All the changes that have been made were instigated with the desire to increase the accessibility of the motor-generator, as well as to decrease size and improve electrical characteristics. Present-day motor-generators are as free from defects as present-day materials will

allow, and years of trouble-free service can be expected.

One of the reasons for the excellent life of a motor-generator is that the parts are accessible, and inspection can be made with utmost ease. Some of the older machines failed because this accessibility was not present, so normal maintenance was neglected. Today's design minimizes the chance that the maintenance man will neglect his normal maintenance.

With all the improvements that have been made in motor-generators, it must be obvious that the present-day generator manufacturer's factory is quite different than his predecessors. It has become a precision manufacturing plant, with controls on each operation to assure uniform production. Rigid inspection coupled with high-quality manufacturing methods assure the user of trouble-free service from this power source.

The aim in today's plant is increased efficiency of the material used. It has been proven by experience that the commercial generator is not suitable for electroplating, and the manufacturer continually strives to improve his equipment from the standpoint of efficiency, life, size and weight.

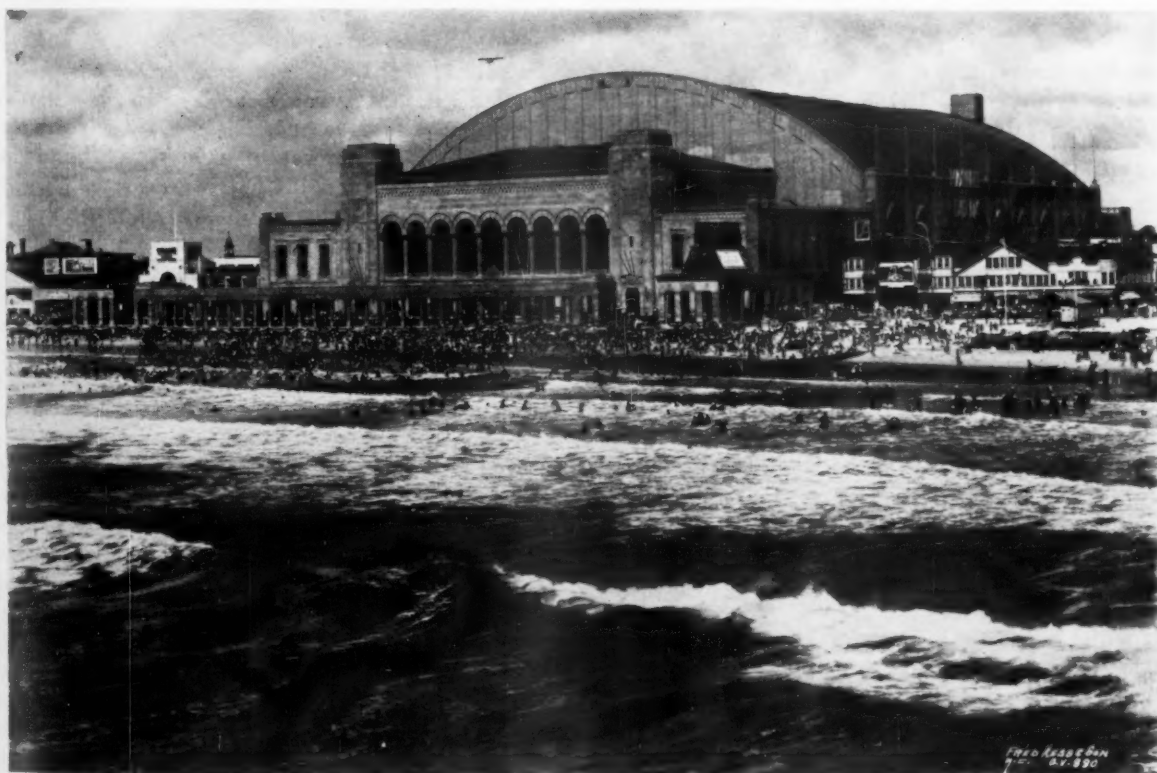
Much has been accomplished in the past and much will be accomplished in the future. The plating man should keep aware of the improvements made so that he will always have the best equipment available. The best way is to review the equipment with a qualified equipment supplier taking into account the points brought out in this article such as type of work to be done, etc. And, most important, have an actual test of efficiency made, so that you will know what your power bill is costing in comparison to new equipment.

After the survey has been made, the plater may purchase new equipment if the results of the survey indicate this to be the proper action. The equipment should be purchased for the specific work to be done so as to increase efficiency and safety.

Motor-generators can be constructed for either manual or automatic control. If the volume and type of work warrants it, an automatic unit will result in better plating, since the vagaries of the worker is held to a minimum.

Modern, efficient motor-generators will eliminate a great deal of the "hidden" operating costs of your power supply and give long and trouble-free service.

CONVENTION HALL, ATLANTIC CITY, N. J.



Site of American Electroplaters' Finishing Exposition

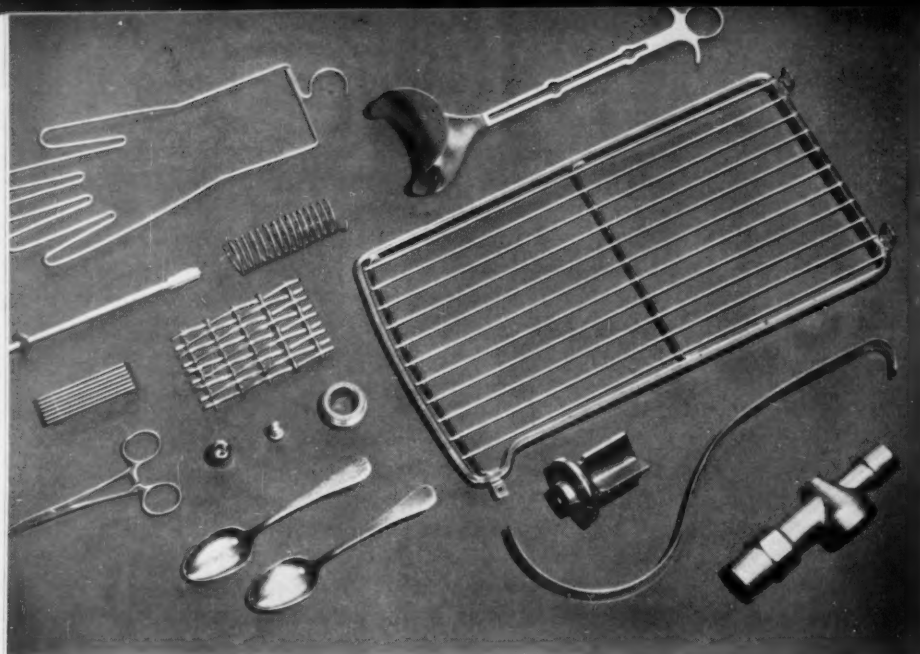


Figure 1. Stainless steel parts made from bars, wire, forgings, tubing or flat-rolled products finished by means of electropolishing.

(Courtesy American Rolling Mill Co.)

Fabricating and Finishing Stainless Steel Part IV

By Arthur P. Schulze, Lakewood 7, Ohio

In this paper, the fourth in a series on stainless steel finishing, the author explains electropolishing. Ten chief reasons for using this process are listed and all necessary information, including formulas and detailed operating instructions, is given.—Ed.

ACROSS the past few years particularly, industrial interest in a new method of treating and finishing metal surfaces has increased at such a rapid rate that today it is fast assuming a place of considerable importance in postwar metal finishing. Reconversion kinks, equipment and materials shortages, plus the lack of good polishers and buffers, are opening up many opportunities for the method.¹

This production process, originally called "electrolytic polishing," is now more commonly known by the condensed descriptive term of electropolishing.

Electropolishing

It is, as the name directly implies, an electrolytic treatment for surfacing, machining, or finishing metals by which the work is made the anode in a solution of a suitable electrolyte so designed to produce controlled finishes ranging from a white matte through a semi-luster up to a lasting, lustrous polish.²

Already the method has proved a popular process for finishing both ferrous and nonferrous metals and alloys of many different types—stainless steel, aluminum, nickel, Monel and copper, to name a repre-

sentative few.¹ Because of their dense, compact and smooth surfaces, stainless steels, especially the 18-8, 17 chrome and 12 chrome classes, prove particularly adaptable to this method of finishing as they require a minimum of time in the treatment bath with its consequent saving in solution life, power, racking equipment and increased production.³

Plant use in many cases frequently demonstrates that the technique does a faster job and at a lower cost than attained with mechanical methods.⁴ Brilliant color having an exceptionally attractive tone can be produced on many metals in simple and complex shapes without cold working effects, heat affects and attendant distortions often accompanying mechanical surfacing.¹ The fact that electropolishing allows for the production of brilliant color with unusually attractive tone is its chief advantage.⁵

Indicative of the steadily-broadening application range of electropolishing and its expanding utility as an effective tool on a purely volume-output basis, is the long list of products on which its use is presently solidly established. Some typical examples include stainless steel wire forms and resistance-welded wire assemblies, such as refrigerator shelves (welded wire and strip), meat racks, kitchen tools (wire forms and complex shapes), bacon hangers, sausage molds, film developing racks; and forgings, after descaling, where appearance or service dictates a lustrous finish, as is the case with blow gun forgings, surgical instruments, dental instruments and small knurled parts.⁴

Reasons why electropolishing practice is developing at an accelerated pace are numerous, of which these 10⁴ are the chief ones at present:

Production of bright finish for sales appeal.

Impracticability or excessive cost of polishing wire forms mechanically.

Removal of weld scale or discoloration which might cause corrosion.

To improve corrosion resistance. (Smooth, passive surfaces of stainless steels resist borderline conditions better.)

Removal of sharp burrs or edges.

Inspection for quality. (Seams or irregularities of surfaces are exaggerated by electropolishing.)

To eliminate one or more steps in mechanical buffing procedure.

Removal of gray film from fabrication or cleaning at a low cost.

To improve finish of knurled surface.

Control of size or weight.

The Process

Electropolishing involves various fundamental factors. The process itself is best described perhaps by saying that it is just the reverse of electroplating, without many of the cleaning problems so frequently associated with electrodeposition. In electropolishing, the work, as indicated earlier, is made the anode, and metal is removed; in electroplating, the work is the cathode, and metal is added.

Layer of surface metal dissolved to produce micro-smoothness and some microsmoothening¹ depends upon three operational factors: immersion time, surface condition and current density. Normally, electropolishing removes from about .0005" to .001" in 5-10 minutes, and as much as .0015" to .002" after 10-20 minutes. Most generally used grades of stainless steels can be electropolished very effectively, with some, of course, responding better than others. In general, anyone familiar with electrodeposition, especially chromium plating, can operate an electropolishing unit with little guidance, plant experience already accumulated indicates.⁴

Under proper operating conditions in average shop practice, the metal loss usually is approximately .001". Aside from producing a highly polished surface, the advantages of this slight metal loss are quite important. By removing .001", the surface of the work is left in chemically clean condition and surface stresses are removed, thus favoring the formation of continuous and strong oxide surface films.³

Types of Solutions Used

Many types of solutions are usable, but for stainless steels, sulphuric-citric and phosphoric solutions are quite commonly employed. The most economical and technically satisfactory methods are patented, but reasonable license arrangements for use on a non-exclusive, royalty-free basis are generally available.¹

Proved through years of successful production experience as a basis for evaluating the electropolishing process as a production-finishing tool, one noteworthy example (U. S. Pat. No. 2,335,354) comprises ap-

proximately 55-60% citric acid (industrial quality), 15% sulphuric acid and the balance water. Such a solution of sulphuric and an organic acid has been found to provide, among other advantages, indefinitely long life, freedom from noxious fumes and explosions and operation at lower current density.⁴

First cost of the solution is, admittedly, comparatively high, but offsetting this is the indefinitely long life and low current density requirements of the bath. In operation, the solution is maintained between 185°-200° F. Sludge consisting of metal salts (sulphates) which precipitate during this particular process is removed at periodic intervals from the bottom of the tank. Through the use of a reclaim after electropolishing, drag-out losses are minimized.⁴

Another polishing process that also has proved an outstanding contribution to metal finishing* similarly combines the use of a selected acid solution and an electric current, and produces a bright, lustrous finish on the chrome-nickel grades and a bright though somewhat less brilliant finish on the straight chromium grades. The process is well adapted to uniformly bright finishing of drawn, forged, rolled or cast sections and is particularly suitable on parts difficult to polish mechanically.⁶

Among still other treatments typical of those in contemporary commercial use on stainless steels are:²

- | | |
|--|------------|
| (1)—Citric acid | 60% |
| Sulphuric acid | 15% |
| Water | 25% |
| Methyl alcohol | 4% |
| 50-125° C., 0.5-40 amp./sq. in., 1-3 min. | |
| U. S. Pat. 2,331,721 | |
| (2)—Sulphuric | 50% by wt. |
| Glycerol | 40% by wt. |
| Water | 10% by wt. |
| 90-200° F., 300-1,000 amp./sq. ft., 3-9 min. | |

Action of Bath

The action that takes place in an electrolytic polish-

* "Anodic Lustre" by Allegheny Ludlum Steel Corp.



(Courtesy American Rolling Mill Co.)

Figure 2. Combination finishing of stainless steel spoons. Confined surface areas of these spoon handles were sandblasted and the entire surface electropolished, producing a pleasing two-tone effect.

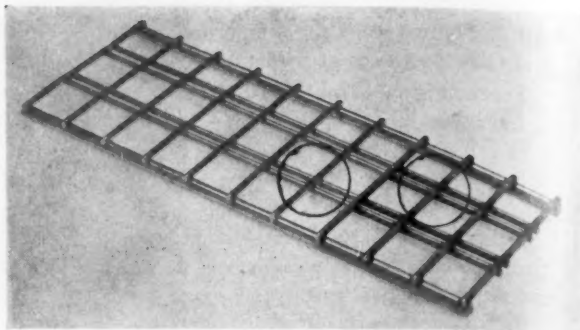
ing bath occurs under highly polarized or pseudo-passive conditions which do not prevail in simple electrolytic cleaning treatments.¹ It may be described by saying that when metals dissolve anodically a film may form on the anode which may change the entire anodic process and is explained best in the words of one authority as follows:²

"The film can be of various nature, such as a gas or a layer of a liquid highly concentrated in the anode material or it may even take the form of a slightly soluble or completely insoluble salt. If this film has a very high resistance to the flow of electric current and the surface being treated comprises minute elevations and depressions such as may be encountered in scratched or pickled metals, we can readily see where the thickness of the film will be much greater in the depressions than at the elevations. This results in a higher current density at the less protected elevations and a consequent low current density in the protected depressions. As these points of higher current density are eaten away, the entire surface of the metal will assume a flatter and flatter characteristic and where there are sharp irregularities in the surface, the sharp corners of them will be rounded off. Another phenomenon usually takes place in a well designed electrolyte and that is the effect of polarization. This polarization takes the form of a higher resistance to the flow of electric current in a selective way. Electrolytic polishing may then also result from the selective removal of elevations on the metallic surface but can occur only if the rate of solution of the elevations is greater than in the depressions. This is effective when the depressions are relatively anodically passive and the elevations are relatively anodically active, due to the difference in the concentration of the anode film."

Treatment Time

Parts must be individually racked with work racks designed to properly handle the type of articles being finished,³ but where racking and handling is relatively uncomplicated, the immersion period often composes the principal consideration from the cost standpoint.⁴ Time required to produce maximum luster ranges from 6 to 15 minutes, and is determined by the surface condition of the metal, size and shape of the part being treated, current density utilized and nature of the electrolyte.³ Roughness of article being treated is also a factor influencing the time element.²

A definite improvement in luster occurs after one minute, but for ordinary smooth surfaces, cold drawn wire, for example, from 5 to 10 minutes is required. Rough surfaces, as in the case of castings, forgings and even surfaces having cold working in only small amount require longer periods . . . perhaps 10 to 15 minutes.⁴ Two typical case reports, using a bath different in chemical composition from the one initially cited, are: one-minute treatment for a stainless steel wire product such as chain, and a 10-minute treatment for a rough casting such as a stainless steel valve.²



(Courtesy American Rolling Mill Co.)

Figure 3. The upper portion of this resistance-welded wire form has been electropolished. The unpolished portion shows weld discoloration which was completely removed by the electropolishing process.

Current Requirements

In electropolishing, as with chrome plating, direct current is used; the source may be either a motor generator or rectifier. For best results in most all electrolytes, current densities generally range from .5 to 1.5 amperes per square inch of surface metal at approximately 6 to 8 volts . . . just about the same as many electrodeposition processes.⁴ Another and equally reliable authority, however, asserts that electropolishing is done at higher current densities and tank voltages than electroplating.¹

A direct current source of 6-12 volts sufficient to polish the largest parts on an optimum schedule can be readily engineered. Adjustment of the number of cathodes, provides different current densities for varying kinds of work. Additional flexibility is achieved by varying the immersion period with the current density.⁴

Tank Requirements

Equipment used in electropolishing is similar to that employed in chromium plating.³ Processing tanks require no unusual materials, being lined with lead, glass, or synthetic resins or rubber.¹ For the sulphuric-hydrofluoric type bath, which operates at room temperature, tanks are most satisfactorily made of wood or cement with a pitch lining; for the sulphuric-phosphoric, straight phosphoric and sulphuric-citric solutions, tanks are generally lead-lined. In these cases, heating of the electrolyte is accomplished with either lead steam coils or electric immersion heaters.² The equipment investment is approximately the same as for electroplating and operating costs are only slightly higher.¹

Successful commercial-scale usage further reveals that when the work is in proper condition, one processing tank and one rinse tank comprise the only equipment requisites for short-run batch-type operations. High-production units, equipped with overhead automatic chain conveyors, have been designed and built up to 33 feet long. However, it is often advisable to use several reclaim and rinse tanks and a preliminary pre-dip in warm 20% nitric acid after degreasing. In electropolishing, unlike electroplating, thorough cleaning is unnecessary, and therefore, not a surface preparation factor of critical importance since electropolishing itself is an excellent cleaning agent.⁴

Racking Requirements

Since the throwing power of the aqueous electrolytic bath generally ranks on about the same level as chrome-plating solutions, individual racking of parts is required. Deep recesses are sometimes difficult to polish and entrapped gas may shield some areas unless auxiliary cathodes and agitation of solution are provided.⁴ Agitation is thus generally recommended to prevent "gas streaks" which are apt to occur when the work hangs motionless and the copious evolution of oxygen, which is developed at the anode, is allowed to follow a straight path over the surface area of the work.²

Work racks or anode hooks are usually made of an acid-resistant copper alloy protected except at the contact point by a stop-off coating.⁴ When made of pure copper they need not be insulated since copper becomes, in most of these baths, quite passive following the first few seconds as anode. The result is that virtually no current is taken by the copper rack which, at the same time, possesses high electrical conductivity.²

Because of its high electrical conductivity and anti-fouling properties, copper is generally used for the cathodes.³ Due to electrolysis at high amperage raising the bath temperature, water-cooled copper tubing or pipe cathodes are oftentimes advised wherever it is necessary to maintain the solutions at room temperatures.²

Operating Conditions

Electropolishing baths lend themselves to simple control measures and seldom require chemical analysis. Inexperienced operators require only a comparatively short time to learn the few control methods needed.³ In production-type installations, of course, solution temperature and current density controls are necessary.⁴

As in some electrochemical surface-processing techniques, overheating may occur. In that case, cooling is effected by mechanical agitation, cooling coils or air agitation. Overheating is most apt to occur in

large-scale volume-type production units. When the current is shut off, air agitation must stop else the solution attacks the copper cathodes. As mentioned previously, immersion heaters are used to maintain the solution temperature. Aside from semi-skilled labor for racking and rinsing the work, the manpower requirements for operating even a large installation have proved small.⁴

Surface Preparation

Proper surface finish, the smoothness and "inherent cleanliness" of the original surface, definitely governs the degree of smoothness, or final appearance of the polished surface obtained, and may determine whether the process can be applied economically.^{3,5} A product may require some mechanical work to remove grinding marks or deep scratches.⁴ Seams, dirt, slag, and nonmetallic inclusions, and certain insoluble phases in some alloys are uncovered and may or may not be removed.⁵

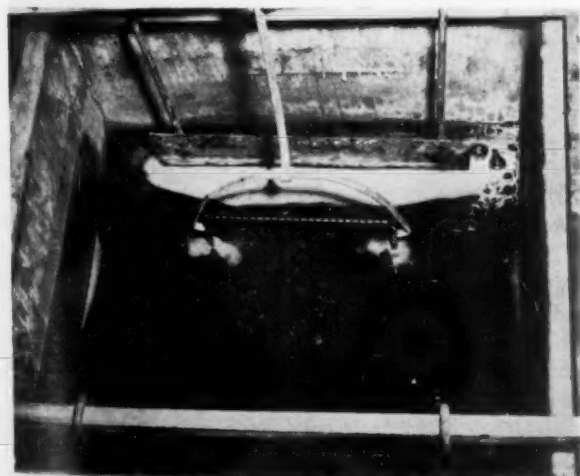
In any case, even on surfaces too rough for practical polishing by other methods, an excellent luster is produced by electropolishing; satin tone to brilliant sparkle is produced in attractive appearance.¹ And by sandblasting or shotblasting before electropolishing, a uniform texture that hides surface irregularities and metal defects, or unusually pleasing two-tone effects can be obtained with the combination of finishes.^{1,4} How much mechanical work is required varies greatly with, and depends largely on, the construction of the individual part as well as the surface condition of the metal or alloy from which it is made. And since electropolishing is not a descaling process, it will not remove hard scale.⁴

From the standpoint of cleaning, preparation of work for processing is relatively simple. It is only necessary to remove lubricants that may interfere with the uniformity of the treatment. This does not include light oils, for instance, but it is recommended that all contaminants be removed to help keep the solution clean.³ Generally, it is most desirable to remove grease, oil and other foreign substances. Sometimes use of a pre-dip in a solution of warm 20% nitric acid is advisable.⁴

On the other hand, it also has been authoritatively reported that parts to be treated frequently require no surface preparation prior to electrolytic polishing and need nothing more than a rinse in running cold water after removal from the bath.²

However, should the work, such as 18-8 stainless, be heavily coated with annealing scale, it may be effectively descaled by treating as the anode in a solution (U. S. Pat. 2,115,005) comprising 55% sulphuric acid, 10% hydrofluoric acid and 35% water. This bath has a decidedly desirable characteristic.²

As portions of the scale are removed, exposing clear metal to the electrolytic action of the bath, these uncovered scale-free areas become passive and pass very little current, resulting in a redistribution of the total current to the parts that are not already descaled. As each succeeding area becomes scale-free, the total current remains essentially the same, but the current density upon the areas still scaled is greatly



(Courtesy Allegheny Ludlum Steel Corp.)

Figure 4. Work in process of being electropolished. Note intense activity at anode and cathode.

increased, thereby speeding up the scale-removing action considerably near the conclusion of the operation. Surface thus attained is especially adapted to receiving a high luster when subsequently electropolished. That is because the pitting usually produced by an ordinary pickling operation is absent in this case.²

Cost Elements

Since electropolishing is accomplished by removing metal, an operation that consumes chemicals, costs are based on direct charges similar to those for electroplating. They may be either lower or higher than for other finishing techniques.¹

As each use must be adopted by "tailor-made" application, which considers the entire manufacturing schedule of a given part or specific product, the cost cannot be expressed by a single, general figure, any more than one over-all figure can be given for the cost involved in making a pound of steel. So costs range from extremes; 0.5 to 25 cents per square foot of surface processed. The "square foot" may be for one part, a portion of a part, or for a large number of small parts. The cost depends on the kind of metal or alloy, its original surface condition, and the kind of bath being used.¹

However, when analyzing the possible use of electropolishing for any specific article, sound practice calls for conducting a comparative study of the costs of finishing by mechanical methods as well. Each individual part is a case by itself, and in some instances, may be finished most economically by processing through a series of polishing operations employing both mechanical and electrolytic means.⁴

No outstanding postwar improvements have yet been made in the methods that were in prewar commercial use.¹ Rivets, screws, nails and similar small parts can be electropolished successfully but up to the present time some difficulties have been encountered in treating large batches in baskets due to entrapped gas and the shielding of parts in the center of the batch. In electropolishing of products of this character, the chief determinant is generally the racking cost.³

Wire shelves, baskets and complex forms as well as forgings are readily brightened at far less cost by electropolishing than by other means. For production runs of many such articles, in fact, electropolishing proves the only practical way of imparting a lustrous finish and usually on a very economical basis.⁴

Initial investment in equipment may be estimated from production rate required, the size, surface area and nature of the work to be treated. Anyone with plating experience, it has been widely found, can establish the approximate tank capacity needed, number of racks, electrodes and accessories. Unless suitable plating equipment is available for conversion into an electropolishing unit, the initial cost of electropolishing equipment may run somewhat higher than the cost of the equipment necessary for mechanical polishing or tumbling. Operating costs are largely determined by two factors: current requirements and handling costs including racking.⁴



(Courtesy Allegheny Ludlum Steel Corp.)

Figure 5. Electropolished work upon removal from electrolyte.

Conclusions

In general it can be said that all established finishing methods have their proper uses under different circumstances. In some instances tumbling may produce a satisfactory finish more economically than electropolishing, while in others, electropolishing will produce a better finish faster and at lower cost.⁴ It must be remembered that electropolishing has individual and interesting applications and is not a substitute for mechanical polishing methods, but rather should be considered as a supplementary process which is capable of producing finishes and effects that no other presently-known means can turn out.²

Of further interest in this connection is the additional fact, which one must recognize and immediately accept, that there is no such thing as an "electrolytic wheel finish." Since electropolishing methods do not provide the same action as mechanical polishing wheels and tumbling barrels, they cannot produce an identical finish. So it is obvious, in view of this, that there are applications where mechanical polishing cannot be replaced by electropolishing. Suitability can be determined only on the basis of whether the results are acceptable in their own right. Electropolishing should never be evaluated on the basis of whether it duplicates a wheel finish.⁵

Electropolishing has been used on a production basis for a sufficient length of time to establish it as a proved, reliable, and, in many cases, a necessary finishing method for a number of types of fabricated stainless steel articles. Already the process generally has made possible the application of stainless steels for articles that previously were not considered because of the costly and difficult finishing problem.³

Presently, more than 100 concerns, both large and small, are engaged in pilot-plant or full-scale production, or both, in the United States. Most installations are for decorative finishing of various metals and alloys, but some are solely for machining benefits realized without cold working effects.⁵

While the need for further improvement and refinement in technique still exists, electropolishing

(Concluded on page 79)

Measurement of Thickness of Oxide Coatings on Aluminum Alloys

By Ralph B. Mason and William C. Cochran, *Aluminum Co. of America*

MEASUREMENTS of the thickness of the oxide coatings formed on aluminum alloys by various electrochemical and chemical treatments are of special value in the control of the several coating processes now being widely used and in the development and evaluation of new coating processes. Characteristics of oxide-coated aluminum such as resistance to corrosion and to abrasion and the ability to absorb dyes or pigments are influenced largely by the thickness of the oxide coating. In the anodic treatment of aluminum, the thickness of the oxide coating formed is dependent to an important degree on the concentration and temperature of the electrolyte, the time of treatment, and the current density employed. Of the various physical measurements made on oxide-coated aluminum, those dealing with the thickness of the oxide coating are the most useful and practical.

A number of different methods are in use at present for determining the thickness of oxide coatings on aluminum alloys. These include the micrometric, the voltage breakdown³, the microscopic^{4, 5}, and the stripping methods^{4, 5}. Of these, the microscopic and stripping methods are the ones most generally used since they give the most accurate and consistent results. These methods, however, have the disadvantage that they are slow and mutilate the specimen. Recently a new electrical method has been developed for measuring the thickness of oxide coatings. This method employs an instrument designated as a Filmeter and is both rapid and nondestructive. Since there is a real need for a test of this character, an investigation was made to determine the practicability of using the Filmeter for measuring oxide coatings on aluminum alloys. The results of this investigation are given in this paper together with a comparison with the results obtainable by the microscopic and the stripping methods.

The Filmeter and Its Operation

The Filmeter or electrical gage^{1, 2} is a portable, battery-operated electronic beat-frequency oscillator contained in a 7 by 7 by 7-in. steel case weighing about 11 lb. complete, manufactured by the American Instrument Co. of Silver Springs, Md. This instrument has two oscillator circuits, one of which is fixed as a reference standard; the other is variable. The inductance coil of the variable oscillator circuit is mounted

on the end of an insulated piston which can move against the pressure of a spring in an aluminum cylinder and is connected to the instrument by a shielded cable. This pick-up coil is placed on the coating to be measured; constant and uniform pressure is maintained by a spring in the shielded aluminum cylinder. The current flowing in the coil induces eddy currents in the base metal under the oxide coating. The intensity of the eddy currents varies with the distance between the coil and the base metal and the inductance of the test coil changes proportionally to the intensity of the eddy currents and in turn controls the frequency of the oscillator current. Change in frequency is measured by rotating a 4-in. dial of a variable air condenser until the frequency returns to its original value. By means of earphones the operator can determine when the two oscillator circuits are tuned to the same frequency.

In operation, the calibrated dial of the air condenser used for measuring the thickness is set at zero and the pickup is placed on bare metal which must be of the same alloy, temper, and smoothness as the base metal under the coating being measured. The small dial of the adjusting air condenser is then turned to the point where the tone just ceases to be audible in the phones. At this point the oscillator circuits have the same frequency. The pickup coil is then placed on the coating to be measured and a tone is heard again. The calibrated dial for measuring thickness is rotated until this tone just stops. At this point the reading of the dial is taken and by applying a calibration factor the thickness of the oxide coating is found.

While it is possible to calibrate the condenser dial directly in millimeters or inches, it is usually more practical to establish a calibration curve for the dial readings. The instrument has been so designed that the distances of the pickup coil from the metal surface are directly proportional to the dial readings, thus making the calibration curve a straight line passing through the origin. It is possible, therefore, to calibrate the instrument by determining the dial reading for a film of known thickness and thus establish one point on a calibration curve. A sample of mica or lacquer film of known thickness is furnished with the instrument for the purpose of calibration.

If a piece of bare metal of the same smoothness and alloy as the piece of metal under the coating being measured is not available and it is not objectionable to have a small area of the oxide coating removed from the specimen, there is an alternate method for setting

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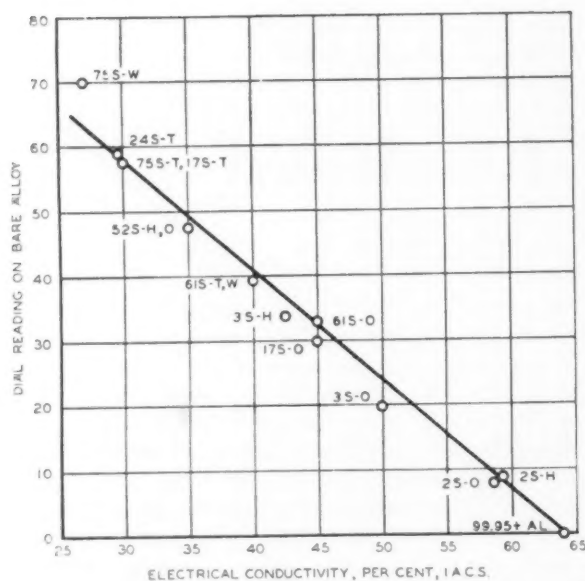


Fig. 1. Dial readings of the variable air condenser as a function of the electrical conductivity of the metal.

the zero point. A drop of 10 per cent aqueous caustic soda solution placed on the oxide coating will remove enough oxide to enable the operator to place the spacer pin (diameter about) of 1/16 the pickup coil against the bare metal and obtain a zero setting. It is necessary only that this pin, whose purpose is to provide a constant distance between the surface and the pickup coil, touch the bare metal. The caustic solution should be washed off as soon as gassing indicates that the bare metal has been reached. It may be necessary to apply fresh caustic solution before the coating is completely dissolved away, but the total time required should not be more than 2 or 3 min.

The principal limitation of the Filmeter is that curved or rough surfaces cannot be measured accurately. The manufacturer has recommended that if the measurements are to be made on concave or convex surfaces, the radius of curvature of the specimen must be 6 in. or greater. The aluminum-base metal should be at least 0.011 in. thick and the surface roughness should be less than 2 per cent of the coating thickness. There is no limitation to the maximum thickness of the base metal. In the original article on the electrical gage² it is stated that the edge of the pickup coil should not be placed nearer than 1/2 in. to the edge of the specimen, otherwise the inductance of the oscillator coil will be affected.

Testing and Calibration of the Filmeter

The following experiments were carried out to test the Filmeter for the measurement of the thickness of anodic oxide coatings on aluminum and its alloys and at the same time to find out whether different calibration factors are necessary for oxide coatings formed on the various aluminum alloys.

It was decided to calibrate the condenser dial readings of the instrument against the thickness measurements obtained by the microscopic method. Assuming a plane, smooth surface, the electrical gage readings that one gets on an oxide-coated specimen depend

on two factors: (1) the distance between the pickup coil and the base metal, and (2) the conductivity of the base metal. It is known that the eddy currents which change the inductance of the pickup coil vary in intensity with the conductivity of the base metal. Therefore, to start with it was deemed necessary to establish a relationship between the conductivity of the base metal and the Filmeter readings made on it. To accomplish this, a piece of high-purity aluminum sheet (99.95 + per cent purity) was used for setting the zero point. The pickup coil was then placed on different bare aluminum alloys and the calibrated condenser dial rotated until the tone just stopped in the phones. These readings were a measure of the difference in conductivity of the pure aluminum specimen and the alloy. The higher the condenser dial reading of the Filmeter, the lower the conductivity of the alloy. The electrical conductivity of high-purity aluminum is 64 per cent of the International Annealed Copper Standard. Since this value is higher than that for any aluminum alloy, it is possible to use high-purity metal as a reference standard for measuring the electrical conductivity of aluminum alloys with the Filmeter.

To establish the graph giving the relationship between the electrical conductivity and the condenser dial reading of the Filmeter on the bare alloy, several alloys whose conductivities were known were carefully buffed to present a smooth surface. The specimens were 2 by 6 by 0.064 in. At least three readings were

TABLE I.—THICKNESS MEASUREMENT OF ANODIC COATINGS ON DIFFERENT ALUMINUM ALLOYS WITH THE MICROSCOPE AND FILMETER.

	Thickness by Microscope, mils	Thickness by Filmeter, ^a mils
No. 1 Reflector.....	0.95	0.98
No. 2 Reflector.....	1.05	1.05
2S-O.....	1.09	1.09
2S-H.....	0.94	0.94
3S-O.....	0.92	0.90
3S-H.....	0.70	0.72
4S-O.....	0.73	0.73
4S-H.....	0.73	0.74
17S-O.....	0.61	0.62
17S-T.....	0.71	0.72
24S-T.....	0.84	0.85
52S-H.....	0.59	0.59
52S-O.....	0.86	0.85
53S—as extruded...	0.88	0.87
61S-O.....	0.84	0.84
61S-W.....	0.95	0.94
61S-T.....	0.97	0.97
63S—as extruded...	1.06	1.05
63S-O.....	0.90	0.91
63S-T.....	1.22	1.25
75S-O.....	0.60	0.61
75S-W.....	0.67	0.67
75S-T.....	0.66	0.64
Alclad 24S-T.....	1.11	1.12

^a Calibration factor of 0.014.

NOTE.—The thickness by microscope is an average of ten readings. The thickness by Filmeter is an average of at least three readings.

made on each bare alloy with the electrical gage. The average of these values for each alloy was then plotted against conductivity as shown in Fig. 1. The graph is practically a straight line. Having established this relationship the next step was to see whether there was any relationship between the electrical conductivity of the alloy and the calibration factor or to prove that the calibration factor was not appreciably affected by the electrical conductivity of the metal.

About two dozen alloy specimens were anodically coated and their coating thickness measured by the electrical gage and by the microscope. The procedure was as follows:

Panels of each different alloy, 2 by 6 by 0.064 in., were buffed on one side. They were then anodically coated for approximately 1 hr. in a 15 per cent by weight sulfuric acid electrolyte at 70 F., with a direct current density of about 12 amp. per sq. ft. When the coating was completed, a 1-in. strip was cut off one end of each panel and used to measure the coating thickness by the microscopic method. Next, one half of the remaining panel was stripped of its oxide coat-

TABLE II.—NOMINAL COMPOSITION OF WROUGHT ALUMINUM ALLOYS.*

Alloy	Per Cent of Alloying Elements—Aluminum and Normal Impurities Constitute Remainder					
	Copper	Silicon	Manganese	Magnesium	Zinc	Chromium
2S.....	..	..	1.2	..	..	..
3S.....	..	..	..	..	..	..
4S.....	..	..	1.2	1.0	..	..
17S.....	4.0	..	0.5	0.5	..	..
24S.....	4.5	..	0.6	1.5	..	..
32S.....	..	..	..	2.5	..	0.25
53S.....	..	0.7	..	1.3	..	0.25
61S.....	0.25	0.6	..	1.0	..	0.25
63S.....	..	0.4	..	0.7	..	..
73S.....	1.6	..	0.2	2.5	5.6	0.3

* Heat-treatment symbols have been omitted since composition does not vary for different heat-treatment practices.

ing by means of the standard phosphoric-chromic acid stripping solution⁴. Finally, the coating thickness of each panel was measured with the Filmeter, using the stripped portion of each specimen to adjust the instrument to the zero point. Thus the bare metal used for setting the zero point was exactly the same as the base metal under the oxide coating, since the stripping solution used does not attack aluminum. At least three readings were made with the Filmeter at different points on the oxide coating. The thickness of oxide coating in mils obtained by the microscopic method was then divided by the average of these readings to get the proper calibration factor for each different alloy.

Figure 2 shows the results of plotting electrical conductivity and the calibration factor for each alloy measured. It appears that the calibration factor is, for all practical purposes, independent of the electrical conductivity of the base metal. For the particular Filmeter used in these tests, a calibration factor of 0.014, which is a fair average, can be used without introducing an important effect in the thickness measurements. It is to be expected that other instruments may have a different calibration factor. The calibration factor should be checked occasionally on a panel having a heavy oxide coating of known thickness and area, for making the zero setting, from which the coating has been removed with phosphoric and chromic acids.

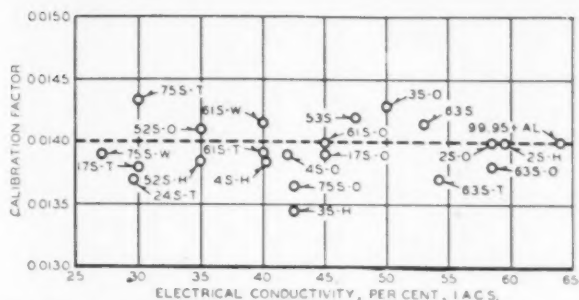


Fig. 2. Calibration factor and electrical conductivity of the metal.

Table I shows the thickness of oxide coatings as measured by the microscope and by the Filmeter. The factor of 0.014 was used for converting all the dial readings to thickness in mils. For the majority of the alloys the coating thicknesses obtained by the two methods do not differ by more than a few per cent. The nominal chemical composition of the aluminum alloys on which the thickness of oxide coatings has been measured is shown in Table II.

Thinking that perhaps the presence of paramagnetic material in an oxide coating would increase the apparent thickness measurement obtained with the Filmeter, porous oxide coatings were impregnated with iron oxide and nickel oxide and measurements were made before and after impregnation. At the most, an increase in apparent thickness of about 0.01 to 0.02 mil was noted.

In order to determine whether the calibration factor of 0.014 would hold for different thicknesses of oxide coating on any one alloy, a series of panels of high-purity aluminum sheet, 2S-H and 24S-T alloys, was anodically coated for 15, 30, 45, and 60 min. in sulfuric acid under standard conditions. These panels were treated in the same manner as those in Table I. Table III gives a comparison of the thickness data obtained with the microscope and the Filmeter. In most cases, the agreement between the two methods is very good and it is safe to conclude that the calibration factor for the Filmeter is the same over the entire range, and that it does not vary significantly with thickness of the oxide coating.

Thus far the thickness values obtained with the Filmeter have been compared with those obtained with the microscope. At this point it is desirable to give some thickness data obtained by stripping and weighing and to compare the three methods. The stripping method, employing the analytical balance for determining weight of coating, was developed for laboratories not equipped for metallographic examination. For

TABLE III.—RESULTS OF MEASUREMENT OF OXIDE COATINGS OF VARIOUS THICKNESSES.

Alloy	Approximate Time of Anodic Coating, min.	Thickness by Microscope, mils	Thickness by Filmeter, mils
99.95+ per cent Al.....	15	0.29	0.29
99.95+ per cent Al.....	30	0.52	0.51
99.95+ per cent Al.....	45	0.71	0.71
99.95+ per cent Al.....	60	0.98	0.98
2S-H.....	15	0.29	0.29
2S-H.....	30	0.42	0.43
2S-H.....	45	0.75	0.74
2S-H.....	60	0.96	0.90
24S-T.....	15	0.29	0.29
24S-T.....	30	0.54	0.54
24S-T.....	45	0.63	0.63
24S-T.....	60	0.84	0.84

* Calibration factor of 0.014.

Note.—The thickness by microscope is an average of ten readings. The thickness by Filmeter is an average of at least three readings.

TABLE IV.—COMPARISON OF THICKNESS MEASUREMENTS MADE BY THREE DIFFERENT METHODS ON ALCLAD MATERIAL.

Alloy	Thickness by Microscope, mils	Thickness by Filmmeter, mils	Weight of Coating, mg. per sq. in.	Thickness by Stripping Method, mils
No. 2 Reflector Sheet (3S core).....	0.14	0.14	4.9	0.11
	0.22	0.25	10.4	0.24
	0.24	0.21	9.8	0.22
	0.33	0.33	14.2	0.33
	0.43	0.44	18.9	0.43
	0.45	0.48	20.9	0.48
	0.69	0.69	31.2	0.72
No. 2 Reflector Sheet (2S core).....	0.91	0.91	40.8	0.94
	0.15	0.10	4.8	0.11
	0.22	0.24	9.4	0.21
	0.23	0.27	10.3	0.23
	0.30	0.33	13.8	0.32
	0.47	0.50	19.8	0.46
	0.70	0.77	29.9	0.69
Alclad 75S (75S alloy core, 72S alloy coating).....	0.94	0.95	39.4	0.91
	0.23	0.24	10.0	0.23
	0.43	0.51	20.4	0.47
	0.67	0.72	30.2	0.70
	0.88	0.95	40.2	0.93

NOTE.—The thickness by microscope is an average of ten readings. The thickness by Filmmeter is an average of at least three readings.

many purposes the weight of oxide coating per unit area is just as useful as the measurements of thickness and besides can be determined very accurately.

In the stripping method a sample of oxide-coated aluminum of known area is carefully weighed on an analytical balance and then immersed in a 5 per cent solution of phosphoric acid containing about 2 per cent chromic acid anhydride at 180 F. for 5 min. or until all the oxide coating is removed. After washing, the specimen is dried and weighed again. The weight of oxide coating is obtained by difference and the thickness found by dividing the weight by the density. When the density of the oxide is known accurately, this method gives consistent and reliable results. The method was originally developed for coatings on high-purity aluminum but has been extended to cover most of the wrought aluminum alloys. It is not suitable for use on some castings.

Alclad products are anodically coated in many cases, and it was deemed desirable to compare the three methods of measuring oxide coatings on this type of material. Specimens of No. 2 Reflector sheet* with 2S and 3S cores and of Alclad 75S sheet were anodically coated for 15, 30, 45, and 60 min. and handled in the same way as those in Table I except that the panels were carefully weighed before and after stripping one half the surface area in the hot mixture of phosphoric and chromic acids. The area of the stripped surface including the edges was carefully measured to find the weight of coating per square inch. Dividing by the density of the oxide coating (in this case 43 g. per cu. in.), the thickness of the coating was obtained. The thickness data obtained by the three methods are recorded in Table IV. It is apparent that some of the Filmmeter values are somewhat high on the Alclad 2S and 75S.

The thicknesses of oxide coatings on the panels of No. 2 Reflector sheet with the 3S core (Table IV) were measured, using untreated material for the zero setting. The error in coating thickness introduced by taking the zero setting on the untreated panel has been plotted against the decrease in thickness of alclad layer in Fig. 3. When the zero setting is made on an untreated specimen of No. 2 Reflector sheet with a core of 3S metal, the error in thickness measurements of oxide coatings progressively increases as the time of anodic treatment increases. In the Alumilite process a cer-

* No. 2 reflector sheet is a composite product having a coating or coatings of high-purity aluminum and a core of either 2S or 3S alloy.

tain amount of the alclad surface is used up as the oxide coating is formed and as the oxide coating increases in thickness the thickness of the alclad surface layer decreases. Consequently, the pickup coil of the Filmmeter is separated from the poorly conducting 3S core material by less and less of the highly conducting alclad layer as the time of anodic treatment increases. When the alclad coating has about the same electrical conductivity as the core material, for example No. 2 Reflector sheet with a 2S core, it makes little difference in the measurement of the oxide coating thickness whether the zero setting is made on the untreated material or on the stripped area. However, for making accurate measurements with the Filmmeter it is good practice to make the zero setting on a stripped area, especially when the alloy is not known or the material is of the alclad type.

In order to compare the three methods of measuring oxide coating thickness further, another series of aluminum alloy panels was prepared with approximately 20-min. coatings, water-sealed. After removing strips for measurement with the microscope, the thickness of oxide coating was measured with the Filmmeter. The same specimens were weighed, stripped, and weighed again to determine the weight of oxide coating. The area was accurately measured and the weight in grams per square inch divided by the density to give the thickness in inches. The results of this series of measurements are shown in Table V.

The measurements so far reported for the Filmmeter have been carried out under good laboratory conditions. To obtain accurate measurements the surface roughness should not exceed 2 per cent of the thickness of the coating being measured. To illustrate the effect of roughness of surface on the Filmmeter measurements, two simple experiments will be described. In the

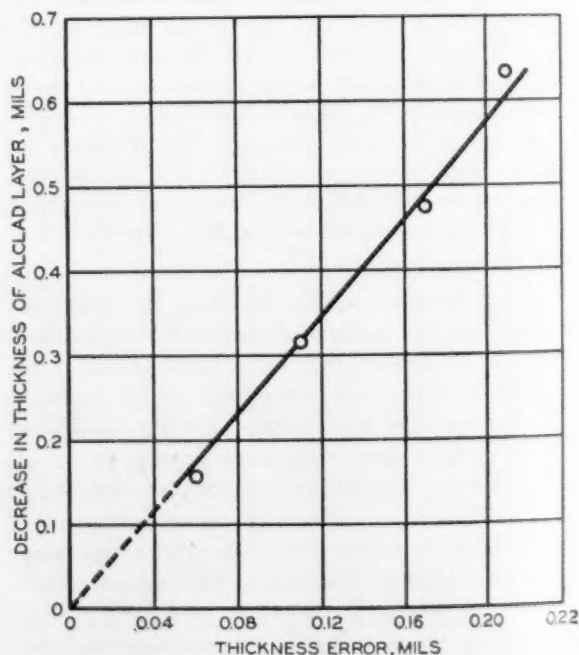


Fig. 3. Apparent errors in thickness of oxide coatings introduced by variations in thickness of Alclad layer.

TABLE V.—THICKNESS MEASUREMENTS ON VARIOUS ALUMINUM ALLOYS.

Density values for sealed oxide coatings from unpublished data.
Density on 24S-T = 33 g. per cu. in.
Density on 73S-T = 38 g. per cu. in.
Density on Others = 43 g. per cu. in.

Alloy	Thickness by Microscope, mils	Thickness by Filmeter, mils	Weight of Coating, mg. per sq. in.	Thickness by Stripping Method, mils
73S-T	0.22	0.37	8.73	0.23
41S-T	0.24	0.24	10.2	0.24
24S-T	0.20	0.21	6.65	0.20
13S-H	0.24	0.24	10.3	0.24
3S-H	0.25	0.21	10.1	0.23
25H	0.24	0.23	10.3	0.24

Note.—The thickness by microscope is an average of ten readings. The thickness by Filmeter is an average of at least three readings.

first experiment, the surface of a 24S-T specimen with an oxide coating 0.37 mil in thickness was slightly indented. When the pin of the oscillator coil was placed in this indentation there was no tone in the circuit, indicating that the coil was as close to the aluminum surface as when placed on bare metal. In this case, the depth of the indentation was as great as the thickness of the oxide coating. Making a measurement with the pin of the oscillator coil in the indentation, the instrument would record a coating thickness of zero. Turning the specimen over and centering the pin of the oscillator coil on the slightly elevated area opposite the indentation, the Filmeter gave a thickness reading of about 0.69 mil, an error of nearly 90 per cent.

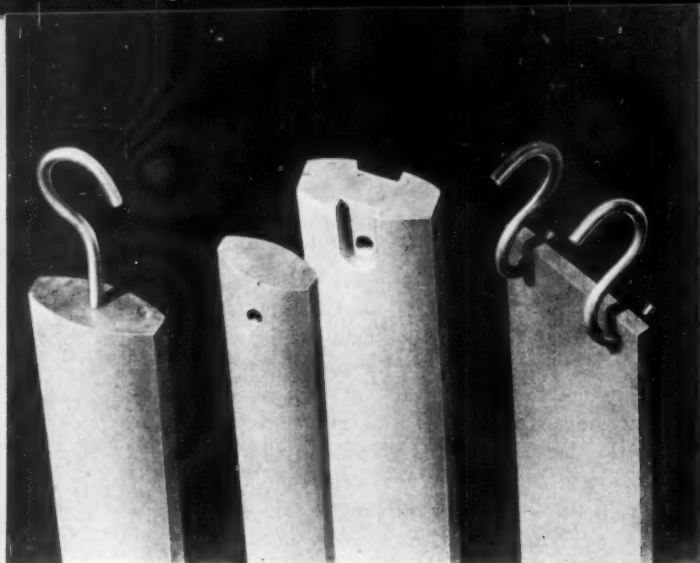
In the second experiment on roughness of surface, two specimens of 2S sheet were uniformly roughened by etching. One of the specimens was anodically coated for about 1 hr. to give a thick oxide coating and one half the coating was stripped in phosphoric-chromic acid. The Filmeter values for coating thickness were 1.11, 0.87, or 0.75 mils depending on whether the zero setting was made on smooth metal, the stripped surface, or the originally etched surface. The second value where the zero setting was made on the stripped area is very nearly correct. Considering the three values, the anodic treatment apparently has some smoothing action on the original rough surface. As an additional check the Filmeter was set to zero on a smooth bare piece of 99.95+ per cent aluminum and the following dial readings obtained, namely, 9.7, 27.9, and 37 depending on whether the oscillator coil was placed on smooth 2S, the stripped area, or the original etched surface. The Filmeter might possibly be used to obtain a quantitative figure for the roughness of a surface.

Conclusions

From this investigation of the use of the Filmeter for measuring the thickness of oxide coatings on aluminum alloys, it is concluded that this instrument provides a new and useful means for checking thickness and uniformity of oxide coatings. The measurements can be made rapidly without destruction of the part and with an accuracy of the same degree as that obtained by the more time-consuming microscopic and stripping methods. Accuracy of the measurements, however, depends largely on obtaining a satisfactory zero setting for the different aluminum alloys and tempers that may be involved and on having surfaces of suitable flatness and smoothness. The zero setting varies as the conductivity of the alloy being measured. It is necessary, therefore, to obtain a zero setting on a sample of the same composition or temper before making a measurement or to strip a small area of the coating by chemical means and make the zero setting on an uncoated portion of the sample being measured. In addition to measuring the thickness of the oxide coating on aluminum alloys, the Filmeter can be used to give a rough measure of the conductivity of these alloys and in some cases provide an approximate means of alloy identification. With the proper technique, it is also possible to detect differences in the thickness of alclad coating layers on core materials which are of lower conductivity than the coating. Finally the Filmeter should prove to be a very useful tool for the routine checking of oxide coatings on wrought aluminum alloys.

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(Courtesy American Brass Co.)

This is the concluding article of this series on plating anodes, and discusses the various factors of importance in the selection and use of anodes for nickel plating, with special reference to bright nickel baths.—ED.

A VERY considerable portion of the total nickel production of the world is used by the electro-finishing industry, i.e., in the first place, for the production of nickel anodes. All improvements effected in the metallurgy of nickel, especially as to the purity of the nickel produced, are therefore of equal importance to the nickel-plating industry.

Nickel electrolytes are highly sensitive towards most impurities, although not all of them are derived from the anodes—as will be shown later on. The most deteriorating impurities under normal plating conditions are chromium, arsenic, zinc and tin. Very small percentages of these elements exert themselves very unfavourably on the various phases of the nickel-plating process. For instance, chromic acid in the electrolyte diminishes the throwing power and impairs the technical properties of the plating. Arsenic causes the formation of grey, streaky, brittle and sometimes porous deposits, while the presence of zinc leads to the production of dark, streaky and peeling nickel-plating. Tin reacts in a similar manner to zinc.

Alloying Additions

Nickel anodes may contain copper, iron, manganese, magnesium, carbon and silicon, while the deteriorating impurities of nickel electrolytes (with the exception of zinc) are rarely derived from the anodes but practically always from the nickel salts added to the electrolytes and (in the case of tin) from cathode materials such as white metals. Appreciable amounts of copper cause the production of dark unattractive deposits and reduce the corrosion resistance of nickel-plating, while still smaller percentages of iron in the anodes increase the formation of slimes in the system. Where the iron compounds present in the electrolytes are deposited on the cathode in form of basic iron salts they lead to the

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Anodes—Part III

Conclusion

By E. R. Thews, London, England

production of non-uniform or even porous nickel-plating. The nickel content of the anodes should amount to at least 99 per cent.

A very peculiar characteristic of nickel anodes is their increasing tendency towards passivity in sulphate electrolytes with increasing degree of purity. This tendency can be counteracted only by the addition of chlorides to the electrolyte. This fact explains the unfavourable attitude formerly exhibited by the nickel-plating industry against the introduction of anodes of greater purity and the years required to convince many platers of the advantages offered by the 99 per cent nickel anodes which are now employed almost exclusively. The same resistance is now frequently shown against the introduction of the 99.5 per cent nickel anodes which naturally develop a still greater tendency towards passivity by electrolytic loading with oxygen.

Nickel anodes are employed in form of cast, rolled, sintered, hammered and electrolytically produced anodes. Special types of anodes of comparatively recent development are the "carbonized" and the "depolarized" nickel anodes, the latter containing up to 0.20 per cent of oxygen.

The advantages and disadvantages of these different types of nickel anodes have been the object of much divergent opinion frequently based on wrong conceptions of the various problems involved. This refers particularly to the advantages and disadvantages of the various anodes in connection with certain types of electrolytes, which more than anything else determine the suitability of the anodes.

Cast Anode Disadvantages

The degree of solubility of the anodes increases with decreasing density of structure. In the case of the normal untreated cast anodes it is three or four times as high as with rolled anodes. The most serious disadvantage of cast anodes is, however, that apart from the production of large quantities of oxide slimes considerable amounts of metallic nickel crystals are disintegrated and drop down into the slimes. This coarse

disintegration of cast nickel anodes is probably due to the fact that their crystal structure is more or less heterogeneous and that in accordance with the differing solvent tendencies of differently sized crystals the rate of solution also becomes irregular, or non-uniform, the less soluble crystals gradually being separated from the structure by the solution of the surrounding crystals. Addition of chlorides to the electrolytes greatly assists in preventing the formation of nickel superoxide, but has no effect on the loss of nickel crystals and the correspondingly rapid consumption of the anodes. The latter disadvantage can be considerably diminished by subjecting the cast anodes to a suitable rolling process, followed by an annealing treatment at a temperature of about 800-815°C.

Another disadvantage induced by the decomposition of the metallic structure is that part of the smallest metal crystals are carried to the cathode faces, leading to the production of rough and easily corroding nickel-plating of cheap appearance. A number of impurities present in cast nickel alloys favour this form of disintegration of the anodes while some others, chiefly silicon and carbon, exert an opposite effect. The graphite content of nickel anodes in electrolytes containing chlorides appears to assist in forming a thin insoluble layer of soft slimes on the anode surfaces which retains the loose crystals until they have been dissolved, preventing excessive losses of metallic nickel in the slimes as well as the formation of rough cathode faces due to deposited small nickel crystals.



(Courtesy Hanson, Van Winkle, Munning Co.)

Fig. 1. Rolled and Depolarized Nickel anode.

This action of the graphite is supported by the silicon content of the nickel anodes which remains on the anode surface in the form of insoluble silica gel or slimes retaining loosened nickel crystals in a similar manner to the graphite slimes, and supporting the corresponding action of the carbon content. An advantageous property of the silicon slime coats is that after a comparatively short time, i.e., before they become too dense and heavy, they drop away from the anodes, while the graphite coatings tend to adhere for a comparatively long period of time and should be removed at regular intervals in order to avoid partial interruption of the passage of electric current.

The useful properties of the carbon content of nickel anodes have led to the development of "carbonized" nickel anodes in the U. S. A. A few American alloys of this type have analyses as shown in Table I.

The adherent coat of slimes induced by the graphite content exerts no resistance against the passage of electric current and, accordingly, against the anodic solution of nickel. If the silicon and carbon contents are correctly proportioned, the tendency of the graphite slimes to adhere to the anodic surfaces is effectively counteracted by the silica slimes. Electrolytes exerting a comparatively strong solvent action on the anode nickel do not require as high a percentage of carbon and silicon in the anode nickel as electrolytes of less pronounced solvent capacities.

The technical properties of cast nickel anodes are influenced to a high degree by the casting methods applied. It is obvious that anodes of uniform, non-porous structure and smooth, dense surfaces should be produced. The degree of density and porosity exhibited by a cast nickel anode can be easily determined by striking the freely suspended anodes with a hammer. The higher the degree of density and non-porosity of an anode, the clearer is the ring produced.

Table I
CARBONIZED ANODES

COMPOSITION	ROLLED PER CENT	CAST PER CENT
Carbon	0.08 -0.15	0.08-0.30
Iron	0.03 -0.15	0.10-0.50
Manganese	0.05 -0.15	nil
Copper	0.02 -0.10	0.01-0.05
Silicon	0.05 -0.08	0.10-0.35
Sulphur	0.005-0.10	0.01-0.025
Nickel	Remainder	Remainder

It is still presumed by some electroplaters that cast nickel anodes should be cast in sand moulds and cooled off as slowly as possible. This presumption is erroneous, at least in the radical form stated. It is true that in most anode foundries the sand casting processes have been developed to a higher degree than the production of chill castings, but very good results can also be realized with chill-cast nickel anodes. Indeed, there can be no doubt that if the latter are produced to speci-

fication and subjected to a correct finishing treatment they develop better plating properties than ordinary sand-cast anodes, unless these are given a mechanical treatment such as hammering or rolling, followed by annealing at a temperature of 815°C.

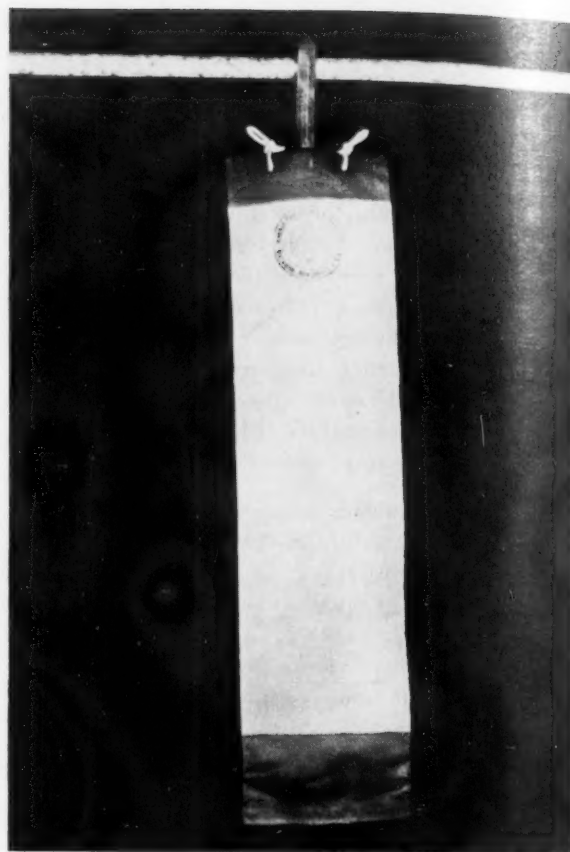
The melting treatment of the anode nickel does not offer any special difficulties above those experienced in ordinary nickel melting. Special attention must be paid to the absorption capacity of nickel for certain constituents of the firing gases, particularly for carbon monoxide and dioxide and for sulphur dioxide. The nickel is melted in graphite crucibles lined with fireclay or in electric furnaces. It is advisable to ensure rapid melting of the nickel (reducing the gas absorption) by preheating the crucible to light red heat and the nickel bars, or blocks, to a temperature of 600/700°C in a suitable annealing furnace.

After charging the nickel, a few handfuls of a flux mixture containing glass and gypsum with salt or flour-spar (all carefully ground and mixed) is added. The crucible must be kept tightly closed against the entrance of firing gases and air to the metal. Deoxidation is effected with manganese or magnesium, the latter being the more advantageous of the two. The oxide and sulphide of magnesium formed by this reaction are soluble in nickel sulphate electrolytes and do not influence the character of the nickel deposits. Manganese sulphide, on the other hand, is insoluble and is gradually transported to the anode surfaces, causing the formation of rough deposits.

Anode Scrap

A rather debatable problem is that of the addition of anode scrap to the melting mixture. Most anode foundries use pure virgin nickel exclusively, but if the scrap is carefully cleaned by sand blasting, etc., good results can be obtained. It is advisable in this case to add a small percentage of nickel oxide to the melt previous to deoxidation. The metal is then covered with one of the fluxing mixtures and deoxidized by adding about 0.10 per cent of magnesium.

Before pouring the metal it should always be subjected to a simple test indicating the degree of purity of the nickel. A test bar is poured into a small iron mould 1 in. wide, $\frac{1}{2}$ in. deep and 6 in. long. The cold test sample is clamped into a vice and hammered around a square piece of iron to form an angle of 90°, the degree of bending resistance indicating the degree of purity of the nickel. If the metal is still too hard or even brittle, another 0.02-0.05 per cent of magnesium is added and the bending test repeated. Where for one reason or another, magnesium should not be added in amounts of more than 0.03-0.05 per cent of the total nickel content of the melt, 0.05-0.10 per cent manganese can be added, the final deoxidation being effected with magnesium. If this manganese addition is correctly calculated, satisfactory results can be obtained since the affinity of manganese for oxygen is much more pronounced than for sulphur; all the nickel oxide present in the bath being reduced before the sulphur is removed. If the manganese addition is proportioned so that only the bulk of oxide is reduced, the final results are just as



(Courtesy Hanson, Van Winkle, Munning Co.)

Fig. 2. Glass cloth anode bag for use in low pH bright nickel baths.

satisfactory as those obtained with straight magnesium additions.

The casting temperatures of the nickel are maintained between 1650-1685°C, depending on size and shape of the moulds. Casting must be carried out as quickly as possible and in one uninterrupted stream. It is advisable to place all moulds in the neighbourhood of the furnaces and to draw and pour out the crucibles within a minimum of time.

The sand moulds are made of highly refractory, medium-fat sand, thoroughly dried and provided with a suitable facing usually made of some graphite-clay mixtures prepared with water to form a comparatively thin paste. One or two gates, depending on the size and shape of the anodes should be provided at one narrow edge of the anodes. The moulds should not be placed horizontally but at an angle of 20-30°.

A very important factor determining the success of sandcasting nickel anodes is the rate of cooling. Really satisfactory results are obtained only if the following procedure is adopted:—

1. Pouring temperatures to be kept as low as possible as long as dense castings of smooth surfaces are obtained.
2. Cooling at maximum speed to a temperature below that favouring the growth of coarse crystals.
3. Final cooling to room temperatures as slowly as possible in order to eliminate all internal stresses.

Chill-casting of nickel anodes is carried out in the usual manner for all types of nickel castings, adapting

the general rules already mentioned as far as applicable. If the nickel is melted and deoxidized as already specified, and poured in chill-moulds placed at a medium angle toward the horizontal it will readily fill the moulds at a pouring temperature of about 1,660°C. The casting skin is very thin and is easily removed by a short sandblasting treatment.

Oxide Addition

The fact that the degree of passivity of nickel anodes increases with increasing purity of the metal, while other electrical properties are greatly benefited by any improvement in this respect, has led to numerous investigations to add metallic and non-metallic substances to the anode nickel with the intention of reducing or eliminating this tendency without increasing the amount of metallic impurities present in the electrolytes.

Of the various types of metallic oxides added to anode nickel, nickel oxide appears to be most frequently used. It forms the principle of the well-known "depolarized nickel anodes." The oxygen content of these anodes ranges from 0.05 to 0.20 per cent, corresponding to nickel oxide contents of 0.25 to 0.90 per cent. The oxygen content should never exceed 0.24 per cent (1.10 per cent nickel oxide) since higher percentages of oxide form a eutectic with nickel which tends to impair the uniformity of anodic solution. Two typical depolarized nickel anodes of American origin have the analyses shown in Table II.

In the production of these alloys oxygen is introduced into the fused metal by a special patented process. The metal is then homogenized by rolling, hammering, forging or drop-forging at temperatures of from 927-1,260°C, reducing the cross-section to about one-third of the original.

Perfect results with these anodes are ensured only in electrolytes containing at least 1 oz/gal chloride. A certain degree of acidity is also required. The pH value of the nickel electrolytes should not exceed 5.8, at a current density of about 30 amp/ft.²

Rolled Anodes

During the last ten or fifteen years rolled nickel anodes have commenced to surpass the cast nickel anodes for most purposes, a fact due in the first place to the development of new electrolytes of greater solvent power, especially of the new "rapid nickel-plating electrolytes." If cast anodes are used in connection with these electrolytes the excessive amounts of metal lost through the formation of slimes would render the processes uneconomical.

Exceptions to this general rule are electrolytes possessing pH-values of at least 4, as well as those containing only small percentages of chloride which require the use of cast-nickel anodes, since on account of their dense structure pure rolled anodes are only slightly soluble in these solutions.

Attention is called to the fact, however, that this general rule has its limits, like most others pertaining to plating processes. The degree of solubility, i.e., the solution resistance of rolled nickel anodes depends

chiefly on the degree of rolling; that is, on the degree of compression exerted. Weakly rolled nickel anodes frequently exhibit a degree of solubility almost as pronounced as that of the denser types of cast anodes. Solution resistance and the tendency towards passivity of nickel anodes (of equal purity) increase directly with the degree of density and hardness of the structure. However, this solution resistance never leads to absolute insolubility under modern operating conditions, as it is now possible by a choice of suitable thermal and electrical operating conditions to render practically every type of pure nickel anode easily soluble. Annealing of rolled anodes also increases their solubility.

Where for special reasons normal rolled anodes exhibit too low a degree of solubility while the solubility of cast anodes is too high, it is possible either to use

Table II
ANALYSIS OF DEPOLARIZED ANODES

COMPOSITION	ROLLED PER CENT	CAST PER CENT
Carbon	up to 0.01	up to 0.01
Iron	0.05-0.08	0.10-0.50
Manganese	Nil	Nil
Copper	0.02-0.06	up to 0.01
Silicon	up to 0.01	0.05-0.15
Sulphur	0.003-0.006	0.005-0.010
Oxygen	0.10-0.20	0.05-0.20
Nickel	99.4	99.6

both types of anodes simultaneously and in suitable proportions or to employ hammered cast nickel anodes.

Forged Anodes

These anodes are produced by careful annealing of cast nickel anodes followed by mechanical hammering. Similar results are accomplished by rolling the cast anodes. It is frequently possible with these hammered or rolled anodes to maintain the required nickel content of the electrolytes for a considerable time. The rate of solution can be further regulated by:—

- (1) Suspension of cast or rolled anodes along with the hammered nickel anodes (to increase or reduce the rate of solution).
- (2) Addition of suitable nickel salts to the electrolytes (a method rarely employed).
- (3) Corresponding modification of the electrolyte by increasing or lowering the chloride content.
- (4) Regulation of the operating temperatures as far as the operating conditions involved, and the results obtained, indicate the practical possibility of such modifications and changes.

Electrolytic Anodes

Another type of anode which during the last ten years has been introduced with rising success is the electrolytic nickel anode characterized chiefly by a high degree of purity. This property naturally introduces the typical disadvantage of all pure nickel an-

odes, their tendency towards passivity and reduced solubility. In an unannealed condition these anodes also tend to spall or exfoliate during electrolysis, increasing the loss of metal and leading to the production of rough cathode surfaces unless dense anode bags are provided. These electrolytic anodes also exhibit the disadvantage that they frequently contain inclusions which may lead to a number of difficulties, although these, as well as the low degree of solubility, can be largely eliminated by a suitable annealing treatment at 800°C.

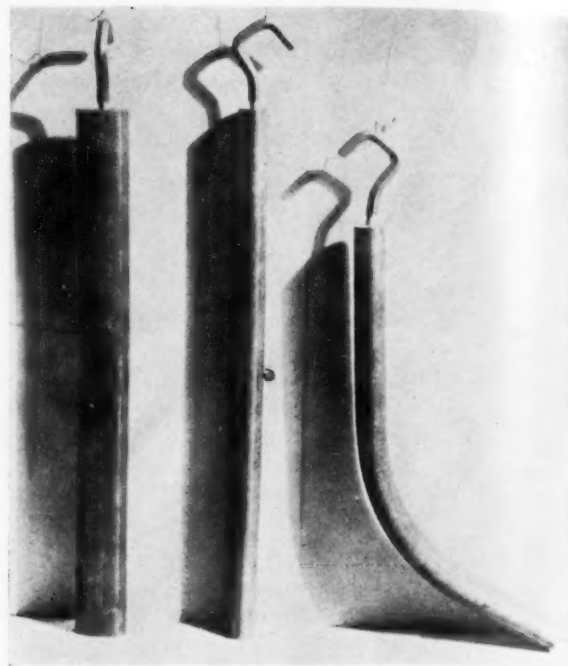
The general mechanical and plating properties of electrolytic nickel anodes are also improved by a rolling treatment followed by annealing at 800°C. This treatment is claimed to suppress the tendency of the anodes towards spalling or exfoliation. The annealing treatment causes recrystallization of the structure which is refined and homogenized; anodic solution is rendered more uniform, and the electrolytic nickel anodes thus treated may be worked to a thin skeleton.

Sintered Anodes

A different type of anodes are the sintered anodes which are produced from carbonyl nickel powder by several patented processes. The powder is pressed to solid shapes which are annealed, hot and cold rolled, etc. Sintering of the anodes takes place in a hydrogen atmosphere. According to more recent (patented) processes, the metal powder is reduced from nickel carbonate and not from the carbonyl, while the sintering process can now be carried out successfully without using a pure hydrogen atmosphere, protection against the oxidizing influence of the air being effected merely by covering the sintered anodes with carbon. The rough-finished sintered anodes exhibit a surface unsuited for plating purposes, and it is necessary for this purpose to subject them to a pickling treatment in acid mixtures consisting either of sulphuric and hydrochloric acids or of nitric and acetic acids.

Since the anode area represents a product of the size, number and shape of anodes, the latter also is an important factor, especially where complicated cathodic shapes require special shaping of the anodes to ensure maximum throwing effects. These anodes are usually made from rolling stock suitably pressed to shape. Ordinary plate-shaped anodes are most commonly employed for all general purposes, the size and weight of these anodes depending on the size and shape of the cathode faces and on the process of manufacture involved. For instance, since cast-nickel anodes weighing more than 100-125 lb are not easily obtained free from faults, heavier anodes are rarely produced. The thickness of the anodes is limited by structural considerations, the crystal structure of anodes heavier than 3 in. to 4 in. being too coarse for electrolytical purposes. Small anodes, therefore, average about 1.5 in. to 2.5 in., while the thickness of larger anodes rarely exceeds 2 in. to 3 in., or at most 4 in.

The length of the anodes depends on size and shape of the cathode material. It is a general rule that the lower edge of the anodes should be located beneath the level of that of the cathodes without approaching too near the bottom of the vat.



(Courtesy Hanson, Van Winkle, Munning Co.)

Fig. 3. Cast elliptical straight and curved types of nickel anodes.

The dimensional ratios (weight: surface area) of rolled nickel anodes naturally are more favourable than those of cast anodes, and there are practically no technical limits with regard to the weight of the anodes produced, although weights of 500 or 600 lb. are never exceeded. The surface areas of the anodes can be increased by the usual devices such as grooving, perforation, special shaping, etc. In many instances sufficiently good results can be obtained by sand blasting the anode surfaces which more than doubles the surface area. Bar or stick anodes as well as the electrolytically produced lattice anodes are other devices for obtaining large surface areas.

Insoluble Anodes

Mention is finally made of the insoluble nickel anodes which, while rarely offering a satisfactory solution of nickel-plating problems, are sometimes employed where nickel salts are more easily and economically obtained than the nickel anodes required. These anodes are usually composed of graphitic carbon or hard lead.

The nickel salts must never be added directly to the electrolyte, but are dissolved in a small amount of electrolyte, the concentrated solution being stirred into the bath. Another method sometimes applied is to tie the insoluble anodes into anode bags which are filled with nickel carbonate. A number of other containers (some of them patented), such as perforated boxes, are also recommended for this purpose. It is clear that the uses of these devices are limited.

Even the best of anodes are only able to perform their duties if they are maintained in an active and clean condition. Proper maintenance of anodes, therefore, is a prerequisite of satisfactory operation. Fresh anodes must be introduced into the electrolyte with a perfectly clean metallic surface. This means that they should be stored in a dry place protected against all

corrosive influences. It is advisable, therefore, that after a prolonged period of storage they should be pickled prior to use while cast anodes require thorough sand-blasting and pickling in order to remove the casting skin. Remaining patches of skin, even if of very restricted area, are bound to lead to excessive waste of metal and to irregular passage of current. The life of the anodes is reduced, the available current concentrating on the free anode areas. The process of solution gradually extends laterally beneath the uncleaned, passive surface area, loosening the surface structure and rendering anodic action uncontrollable. Pickling is effected with dilute sulphuric-hydrochloric acid mixtures.

Maintenance of anodes also extends to the regular cleaning during operation. They should be removed from the electrolyte once a week and sprayed with clean water. Yellow or black oxide crusts must be scraped off and the mechanically cleaned anodes placed into a 5 per cent sulphuric acid solution for about 10 or 12 hours. The oxide layers can also be removed by chemical treatment, i.e., by pickling in a solution containing 10 per cent sulphuric acid and 5 per cent hydrochloric acid. Pickled anodes must be washed and rinsed carefully before being returned into the electrolyte.

If, during electrolysis, crystalline deposits are formed on the anodes these should be removed every few days by suspending the anodes in clean hot water.

Another operation necessary to prolong the life of anodes and to increase the efficiency of the nickel-plating process (or any other electroplating process) is to turn the anodes vertically and horizontally at regular intervals. It does not suffice to change the fronts and backs of the anodes to ensure uniform solution, but the anodes should be turned upside down about once a week in order to counteract the well-known preferred dissolution of the bottom sections of the anodes.

FABRICATING AND FINISHING STAINLESS STEEL

(Concluded from page 68)

unquestionably opens new frontiers for exploration and development in design and appearance and effects new economies in manufacturing methods. Particularly intriguing effects are attainable by shot-blasting, with or without two-tone effects, and then electropolishing to make the article slick to the touch and provide color tone ranging from satin to brilliant sparkle.¹

To those interested in fabricating and finishing stainless steel articles, the possibilities which electropolishing offers deserve investigation. Many fabricators already have available practically all the equipment that would be needed to at least conduct an investigation designed to suit their needs.³ Those who are in doubt as to where or how to start may easily secure technical assistance from responsible stainless steel producers, whose engineers are glad to cooperate freely with any metal-finishing executive anxious to get the complete story on how electropolishing can be utilized most advantageously in his shop or plant.

Slime Formation

A matter of great practical importance is the problem of slime formation and of the metallic decomposition of the anode surfaces. Mention has already been made of the "carbonized" and "depolarized" nickel anodes which develop dense and tenacious surface layers retaining the loosened metallic particles until they have been dissolved electrolytically.

The most common method still employed for this purpose is the use of anode bags made of linen, wool fibres, nettle, raw silk, spun glass, etc. Spun glass bags have been developed for the purpose of providing a bag material applicable in connection with comparatively acid electrolytes (pH-values of 2 and less), as organic bag materials are rapidly destroyed under these conditions. Suitable anode bags have to fulfil a number of requirements not always realized to their full extent.

1. They must consist of a material sufficiently dense to retain even the finest particles of slime (which on drifting to the cathode surfaces usually are the most harmful).
2. They must influence the plating condition in such a manner as to suppress the formation of fine slimes without impeding the passage of the electric current into the electrolyte.

To obtain anode bags of maximum density special weaving methods are applied, or double bags are provided, consisting of inner and outer bags of the same or different materials. The use of combined bags consisting of an inner filter-paper bag and an outer cloth bag is recommended. Attention is called to the fact that freshly manufactured bags usually contain organic substances which if introduced into the electrolyte may lead to the production of faulty nickel plating. New bags should therefore be boiled in a small amount of the electrolyte in which they are to be used.

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Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Phosphoric-Nitric Acid Electropolishing Baths

Question: Do you have any knowledge of the use of combinations of conc. phosphoric and nitric acids for electropolishing or pickling metals?

C. C. C.

Answer: While both of these acids have been used alone or in combination with various other acids for many pickling and electropolishing baths, we can find no record of the use of this particular combination of acids. No doubt workers in the electropolishing field have tried them together, but if such is the case the results were not published.

Plating Wire Fish Traps for Corrosion Resistance

Question: We are using wire fish traps in salt water. The wire has been galvanized, but does not stand up very long. Would some form of plating help to give us longer life on these traps?

B. R. O.

Answer: For a longer salt-water life, we would suggest a heavy cadmium plate or tin plate right over the galvanized coating. You might also consider the possibility of using a coating of the synthetic rubber-like materials such as are commonly used for plating racks. This type of coating would give an extremely resistant surface, and can be applied by dipping.

Converting from Zinc to Cadmium

Question: We have some zinc plating barrels, and would like to know what changes are necessary in order

to change over to cadmium plating in the same equipment?

T. S. B.

Answer: The same equipment as used for barrel zinc plating is also usable for cadmium plating, with no changes required. Be sure to clean out the tank and barrel thoroughly before putting in the new solution and anodes. The formulas for the cadmium solution will be found in the Guidebook-Directory.

Preparing Wax Models for Electroplating

Question: Please let us know if we can use the same method of preparing wax models for plating as we use for plastics?

M. W. B.

Answer: In preparing wax models for electroplating, many different techniques are employed to get the necessary conducting surface on which to deposit metal. A very complete discussion of the various methods is contained in the book "Metallizing Non-Conductors" by Samuel Wein. The problem is different from that of plating on plastics in that suitable wetting agents are usually required, especially if graphite is being used for the conductive coating.

Electropolishing Silver Plate

Question: Some of the parts that we have to silver plate are complicated in shape and therefore difficult to buff properly. We have heard that this type part can be polished electrically, and would appreciate receiving any details regarding this process.

T. A. W.

Answer: Electropolishing of silver-

plated articles has been quite successful in a number of applications such as you mention. The parts may even be polished in the same solution in which the plating is done. We are enclosing tear sheets describing a practical application involving these steps.

Cleaning Kovar Metal-Glass Assemblies

Question: Can you suggest a way to clean Kovar metal after it has been welded to glass? We are required to tin plate over this metal, and have experienced a great deal of difficulty in obtaining a clean surface.

L. H.

Answer: The following solutions may be used for this purpose:

- 1) Hydrochloric Acid 10%
Nitric Acid 10%
Temperature, 160°F.
Time, 2-5 mins.
- 2) Sulfuric Acid 5-10%
Electrolytic pickle, parts cathodic. An inhibitor should be used.
- 3) Hydrochloric Acid 10-15%
Parts anodic, using 6-12 volts at a current density of 10 amps./sq. in.

High Temperature Tarnish Resistant Finish

Question: We would like information on a finishing process that could be used for copper and brass parts that would resist discoloration at temperatures of 500-600°F. Due to the nature of our product, which must go thru a heating cycle such as this, we cannot use a paint finish, and we would like to overcome the oxidizing of the copper and brass parts used in the assembly.

J. P. L.

Answer: The only plating that you could use that would stand temperatures as high as this would be chrome over a heavy nickel base. You might have a problem with adhesion, but I believe you could overcome this with

proper attention to all details of cleaning, etc. Have you considered the possibility of using a protective atmosphere in the furnace in which the parts are heated? A non-oxidizing atmosphere of nitrogen or other inert gas would enable you to prevent the oxidation of the copper and brass parts, and unless the plating was required for other reasons, we believe this method would be better than plating the parts.

Plating Metallic Mesh Handbags

Question: In gold plating mesh bags, we frequently get a brown deposit and sometimes no deposit at all in certain areas. What can we do to get a clear uniform gold? At present we have to scratch brush several times.

H. S.

Answer: We believe your trouble in plating this type of part lies in the fact that poor contact between the strands is interrupting the current and causing faulty plating. To overcome this, the mesh should be tightly stretched on a rack while being plated, thus assuring good contact. A similar condition exists in plating small chains used for jewelry.

Over-Etching Parts Before Plating

Question: We are sending you some samples of our parts which show

whitish spots after nickel plating. We would appreciate it very much if you could suggest a method to overcome this trouble.

O. B.

Answer: The appearance of the parts indicates small depressed areas that appear to be rough and etched, which causes the plating to look whitish or frosty. Your trouble is apparently in the acid dip used prior to plating. I suggest that you either shorten the time the parts are left in the acid tank or else use a weaker acid mixture.

Plating Dentures

Question: We have been experimenting with plating metals on dental impressions, but have not had too much success with the method using copper powders and copper plating. We have heard of a silver process, and would like as much information as you could send us.

M. H. T.

Answer: Compounds have been developed for using a silver "paint" on non-metallic compounds such as wax, plaster of paris, and plastics. This silver paint forms the conductor for the electroplating process, in which silver is plated from the usual cyanide solutions. The name of a supplier for these silver materials is being sent to you. You can also deposit any of the

other metals from their solutions over the silver film. Another method commonly used is to precipitate silver from a solution of silver nitrate with a reducing agent, such as is done in preparing mirrors. This film can also be plated over with other metals.

Etch Lines on Copper Printing Rolls

Question: We are makers of copper printing rolls, and frequently have to strip the thin chrome plating from finished etched cylinders. Often when we do this we find a network of fine lines over the entire copper surface. The action is not consistent, as identical cylinders treated in the same etching solution and for the same time do not show these fine lines. We use 18° Baume Muriatic acid for stripping. Can you tell us how to eliminate this problem?

H. T.

Answer: I believe that the cause of your trouble may lie in the purity of the copper used for these cylinders, inasmuch as the stripping solution seems to work satisfactorily on identically treated rolls. If the copper contains much oxygen in the form of Cu_2O it may be reacting with the hydrogen generated during the chrome plating operation. If such is the case, you could eliminate your problem by using only oxygen-free copper for making up the rolls.

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Patents

Process of Forming Plastic Coating Compositions on Surfaces

U. S. Patent 2,431,315. Folsom E. Drummond, assignor to Chemical Developments Corp.

A method of providing a surface with a tough resinous coating comprising atomizing hydrocarbon material having conjugated double bonds, atomizing cesium, intimately mixing the hydrocarbon and cesium mists obtained, depositing the mixed spray on the article to be coated and allowing it to air dry.

Process of Bright Dipping

U. S. Patent 2,434,021. Merrill M. Thompson and Walter E. Moline, assignors to The National Cash Register Co.

The process of bright-dipping and deburring objects of brass which includes the step of subjecting the objects to the action of a bath which is an aqueous solution consisting of, for each gallon of the solution, 27 ounces of sodium dichromate, 27 ounces of sodium nitrate, 40 ounces of sodium bisulfate, and the remainder water, and which is of sufficiently weak acidity at normal room temperature that it will not appreciably attack objects left therein for as long as 24 hours but which becomes more active through ionization upon increase of temperature until at about 130 degrees Fahrenheit it becomes effective as a bright-dip; and the step of maintaining the bath at a temperature selected between 130 degrees Fahrenheit and the boiling point of the bath, depending upon the desired ionization and rate of action of the bath on the object, whereby a high degree of control of the process is obtained and damage to the objects caused by unduly severe etching of the objects can be avoided.

Heat Resistant Nickel Alloys

U. S. Patent 2,432,149. William Thomas Griffiths, and Leonard Bessemer Pfeil, assignors to The International Nickel Co., Inc.

A heat resistant alloy comprising about 10% to about 30% chromium, about 0.001% to about 0.5% alkaline

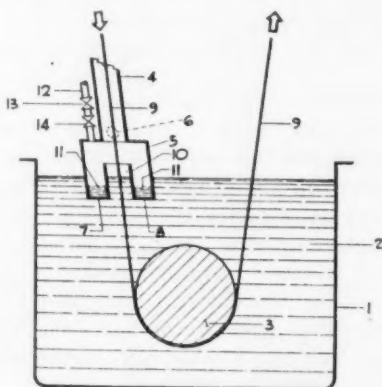
earth metal, about 0.01% to about 0.5% thorium, and the balance substantially nickel.

A heat resistant alloy comprising about 10% to about 30% chromium, about 0.1% to about 50% iron, about 0.001% to about 0.5% alkaline earth metal, about 0.01% to about 0.5% thorium, and the balance substantially nickel.

Process and Means for Improving the Adherence of Aluminum Coatings

U. S. Patent 2,437,919. Kasimir Oganowski, assignor to The American Rolling Mill Co.

An apparatus for the purpose described, in combination with a container for a bath of molten coating metal, a hood terminating in a bell, an end portion of said bell dipping be-



neath said bath, said hood and said bell serving to protect metal to be coated from the external atmosphere while it is carried into said bath, and an open top container for alkali metal located within said bell and formed in part of the bell walls, including inward and upward extensions thereof, said container extending about said bell on the inside and serving to maintain alkali metal in heat exchange relationship to the metal of said bath, the top of said container being open and located in close proximity to the surface of the bath within said bell, and means for introducing alkali metal into said container through the bell wall without opening up said bell to the surrounding atmosphere, said means comprising means in connection with said bell for accepting said alkali metal, and means operable sequentially to close said last mentioned means to the atmosphere in said bell and open it to the external atmos-

phere for receiving said metal, and to close it to the external atmosphere and open it to said bell for admitting said metal to said bell.

In a process of coating ferrous metal articles with molten coating metal of a class consisting of aluminum and aluminum alloys in which the metal articles are passed through a hood into a bath of said molten coating metal, the steps of maintaining a protective atmosphere in the hood substantially non-oxidizing to ferrous metals and introducing an atmosphere containing alkali metal vapor between the surface of said bath of molten coating metal and said protective atmosphere.

Metal Surface Treatment

U. S. Patent 2,433,311. Stanley P. Waugh, assignor to Tide Water Associated Oil Co.

Method for producing a corrosion and wear resistant sulfide coating on the surface of metals normally of low corrosion resistance which comprises applying to the metal surface a composition comprising an organic liquid containing metal reactive sulfur, water and a metal salt of an alkyl ester of a sulfo-dicarboxylic acid in a minor proportion effective to promote reaction of said metal reactive sulfur and the metal surface to produce said sulfide coating thereon and allowing said composition to remain in contact with the metal surface until the said coating is formed.

A metal article having a passivated, bright, corrosion-resistant surface with sulfide reaction products situated at the grain boundaries of the metal structure and being produced by applying to the surface of said article a sulfur-containing organic liquid in the presence of a salt of an alkyl ester of a sulfo-dicarboxylic acid effective to promote reaction between said sulfur and said metal and produce thereon a dull sulfide film, and then removing said dull sulfide film to expose the underlying corrosion-resistant surface.

Platinum Sheet Electrode

U. S. Patent 2,434,731. Alexander E. zu Eltz, assignor to Baker & Co., Inc.

A sheet electrode for electrochemical processes, comprising an electrode plate of electrically conductive corrosion resistant platinum metal, and a channel shaped electrical feeding bar

Cowles

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LIXOL works faster because of its multiple penetrant formulation and good rinsing properties. It produces emulsions that are stable in the face of extreme soil, temperature and water conditions—preventing soil redeposition.

LIXOL is designed for still tank, pre-soak and washing machine equipment. No cleaner of this type works as well in all three because:—

- ★ **LIXOL Penetrates**
- ★ **LIXOL Rinses Easily**
- ★ **LIXOL Cleans Thoroughly**
- ★ **LIXOL Is Stable**
- ★ **LIXOL Prevents Rust**



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Prompt shipments from local stocks.

The Cowles Detergent Company

METAL CLEANER DEPARTMENT

7016 EUCLID AVENUE

CLEVELAND 3, OHIO

METAL FINISHING, May, 1948

having a core of electrically highly conductive metal, said core being subject to corrosion in an unprotected state, said electrical feeder bar, including its involute surfaces, and including all surfaces in contact with the electrode plate, being clad externally with a covering of corrosion resistant platinum metal, the ends of the feeder bar remaining unclad from such points which are safe from corrosion, said electrode plate being mechanically sealed to said feeder bar within the channel of said feeder bar along the full width of the upper portion of the electrode plate and in electrically conducting contact along both sides of said upper portion.

Process of Coating Metal Articles

U. S. Patent 2,434,855. Jose L. Teran Kosterlitzky

The herein described process of plating a metal article which comprises rubbing upon the surfaces of such article, with an applicator which is wet with an aqueous liquid, a composition which contains:

Parts	
Ferrous chloride and stannous chloride	22
Metallic zinc in powder form	About 10
Potassium bitartrate	15 to 25
Ammonium chloride	7 to 12
Nickel sulphate	21 to 35
Nickel ammonium sulphate	41 to 59
Sodium chloride	4.5 to 7.5
Copper sulphate	5 to 11

such composition when in powdered dry form being substantially stable in air of ordinary moisture content.

Production of Metallic Designs on Nonmetallic Materials

U. S. Patent 2,435,889. Frank Enoch Kerridge, assignor to Johnson, Matthey & Co., Ltd.

A process of producing metallic designs on non-metallic materials comprising the steps: (a) providing a non-metallic material with a thin coating of a precious metal selected from the group consisting of silver, gold and palladium evenly distributed over its



surface, (b) coating the resulting metal surface with a film of light-sensitized colloid selected from the group consisting of glue and gelatin and processing said film by photographic methods to produce a positive image in said colloid of the desired design, (c) hardening said image to convert it into a resist, (d) removing the metal not covered by said resist by etching with a solution of a halogen selected from the group consisting of bromine and iodine in a solvent selected from the group consisting of the lower aliphatic alcohols and the esters thereof, thus leaving the design in metal below the resist, and (e) firing the article to burn away the resist and cause the metallic design to adhere firmly to the non-metallic material.

Buffing and Polishing Machine

U. S. Patent 2,434,513. Charles R. Palmer.

A machine of the character described, comprising a frame including a substantially circular base plate having means thereon for supporting a plurality of circumferentially-disposed stationary buffing and polishing elements, a table rotatably supported on said frame, below the plane of said elements, a plurality of horizontally-disposed spindle assemblies mounted on said table with their spindles in endwise relation to and for detachably supporting the articles to be treated for operative engagement with said buffing and polishing elements, means for continuously rotating said table, and means for intermittently transmitting motion to said spindle assemblies when they are in registering relation with said buffing and polishing elements.

Small Parts Holder

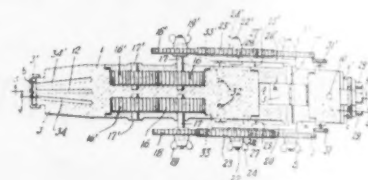
U. S. Patent 2,434,417. Herbert W. Kugler, assignor to Cherry Rivet Co.

In a holder for articles to be immersed in an electrolytic bath or the like, the combination of a container for the articles, a packer substantially in the center of said container having a laterally movable wall in contact with the articles, means including a flexible wall adjacent said movable wall, and means for admitting fluid under pressure on the side of the flexible wall remote from said articles to force the movable wall laterally and thereby crowd the articles into intimate contact with each other.

Metered Spraying Device for Mixed Liquids

U. S. Patent 2,438,462. Ronald B. Smith.

In a liquid dispensing device, the combination comprising a housing, a



nozzle member associated therewith, a plurality of gear pumps for supplying liquid to said nozzle, each gear pump having an inlet conduit and an outlet conduit, a fluid-drive motor, including a rotor element, mounted in said housing, means for supplying motive fluid thereto, a train of variable gearing operatively connecting each gear pump to said rotor and means for simultaneously conducting liquid discharged under pressure by each pump to said nozzle member.

Abrasive Cleaning System

U. S. Patent 2,434,881. Gilbert D. Dill, assignor to American Wheelabrator & Equipment Corp.

In a device for starting a strip or other sheet through a blasting machine, a cabinet having an entrance and an exit, a path for the strip connecting said entrance and exit, a carriage traversing said path, said carriage having a holding device for holding said strip, means propelling said carriage along said path, stop means cooperating with said holding device for releasing said strip when the carriage reaches a predetermined position, means for thereafter propelling said strip freely through the carriage.

Method of Electrodepositing Copper and Baths and Compositions Therefore

*U. S. Patent 2,437,865. Jesse E. Star-
eck, assignor to United Chromium, Inc.*

A method of depositing dense and adherent copper characterized by the bath having a pH between 6.5 and 7.5, and in which the bath consists essentially of 7.5 to 45 g./l. bivalent copper, 100 to 250 g./l. pyrophosphate (P_2O_5), and 5 to 20 g./l. nitrate (NO_3).

Specifications for Electroplated Metals

The following tabulation lists the various specifications in effect at the present time for electroplated metals. Practically all plating work done on military equipment would be expected to conform to one of these specifications. For complete details of each specification, see the hand-books published by the respective bodies.

METAL	SPECIFICATIONS*	SCOPE
CADMIUM	ASTM A-165-40T AMS 2400E AN P-61-2 NAVY 46-P-1	Tentative Spec. for Cadmium on Steel in three types (NS-OS-TS) differing only in thickness. Direct plating on base metal. For stainless steel a flash coating of other metal is permitted. Same as above. Same as above.
ZINC	ASTM A-164-40T AMS 2402-B AN P-32-a NAVY 46-P-2	Tentative Spec. for Zinc on Steel in three types (GS-LS-RS) differing only in thickness. Direct plating on base metal. Direct plating on base metal followed by a chemical treatment to prevent corrosion. Direct plating on base metal.
NICKEL	AN-P-34a	Decorative plating in both matte and bright finishes. Industrial (heavy) plates.
NICKEL & CHROME	ASTM A166-45T ASTM B-141-45 ASTM B-142-45T	Nickel and chrome on Steel for decorative purposes. Four types (DS-FS-KS-QS) differing in thickness of various plates. Nickel and chrome on copper base alloys. Three types (FC-KC-QC) differing only in thickness of nickel deposit. Nickel and chrome on Zinc-base alloys. Three types (FZ-KZ-QZ) differing in nickel and copper thicknesses.
HARD CHROME	ASTM B-177-45T AMS 2406 AN-P-39a NAVY 46-P-3 NAVY 46-P-4	Hard chrome directly on Steel. Hard chrome directly on Steel. Decorative (thin) and Industrial (heavy) deposits. Porous chrome in two types-Channel Point and Pin Point. Decorative (thin) and Industrial (heavy) deposits with either undercoats or direct plating.
TIN	AMS 2408	Direct deposit on base metal from various solutions.
LEAD	ASTM B-200-45T	Deposits on steel-Types ES-MS-PS. Deposits on Copper alloys-Types EES-MMS- and PPS.
LEAD-INDIUM	AMS 2415	Deposition of Lead directly on base metal. Deposition of Indium on Lead plated surface.
SILVER	AMS 2410 AMS 2412	Plating of Silver over a flash Nickel and baking at high temp. Plating of Silver over a Copper strike and baking at low temp.

* ASTM—American Society for Testing Materials.

AMS—Aeronautical Material Specifications—Society of Automotive Engineers.

AN—Army-Navy Specifications.

NAVY—Navy Department Specifications.

Recent Developments

New Methods, Materials and Equipment
for the Metal Finishing Industries

Compact High Capacity Filters

*Commercial Filters Corp., Dept. MF,
A. & W. 3rd Sts., Boston 27, Mass.*

Announcement is made by the above firm of a complete line of filters for industrial applications which are ideally suited to the filtration of plating solu-



tions. At present these filters are in use in some of the country's largest plating plants, including the automotive field.

The outstanding features claimed for this line of filters is their compact construction and low pressure drop, making possible the filtering of much larger volumes of solutions with a given size piece of equipment. Because these filters will operate over long periods of time with no attention required, it is usual to provide individual installations with pumps, etc. on those tanks where continuous filtration is required.

Filters are available in sizes up to 14,000 gallons per hour in a single filter, making high rates of filtration possible.

Nylon Anode Bags and Filter Cloths

*Anode Products Co., Dept. MF, 2559
N. Monitor Ave., Chicago 39, Ill.*

The use of nylon for anode bags, when first introduced to the electroplating industry received quite a setback, due to the weavers using special compounds when looming, which adhered to the fabric, and when submerged in a nickel bath created a contaminated solution. This was cleared up by a washing process which eliminated any possibility of contamination to the various nickel solutions. The argument that Nylon would have to be woven too close in order to retain the carbon and sludge and too much additional voltage would be required to pass the ions from the anode to the cathode was also advanced, but actual tests have proven that Nylon fabrics woven for use as anode bags do not require any more voltage than other fabrics and retain carbon 100% if properly constructed, withstand acids to a pH of 2.5 withstand temperatures to 325° F. without any shrinkage or physical change, and are unaffected by the strongest alkaline solution used, according to the above firm. Salts will not cling to the fabric because of hard, smooth non-absorbing surface, making them very easy to clean. Last but not least, there is no brightener absorption, with nylon bags, it is claimed. Many have wondered why, when installing new bags on anodes, that for the first few days continual adding of some brightener was required. This was because the new cloth bags installed were robbing the bath of the brightener until the saturation point had been reached in the cloth.

For filtration, heavier Nylon fabrics are used. More gallons per hour per square foot of filter area and longer cycles are claimed, the reason being that the porosity of Nylon remains the same under high pressure, similar to that of a wire mesh filter screen. The

life of the Nylon cloth is said to be 3 to 4 times longer than that of the regular fabrics. There is also said to be no dimensional change in these fabrics from the hot solutions which tend to close the pores of other fabrics, thereby cutting down flow rates and reducing length of filter cycle.

Nylon fabrics are unexcelled for filtering highly caustic solutions, as the caustic does not decompose the fabric when permitted to dry for storage, it is claimed.

Improved Polishing Lathes

The Hanson-Van Winkle-Munning Company, Dept. MF, Matawan, New Jersey.

Announcement is made by the above firm that their Type MI and Type MS polishing lathes, in 3, 5 and 7½ HP sizes, can now be supplied with variable speed arrangement. Conveniently located handwheel permits the user to obtain any speed between 1800 and 3600 RPM.

The spindle speed is governed by a variable pitch motor pulley and a single, wide "V"-type belt. The calibrated control moves the motor and pulley assembly which changes drives centers, with the belt tension automatically maintained. Magnetic starters are supplied for all variable speed lathes.

The lathe is ruggedly built into a



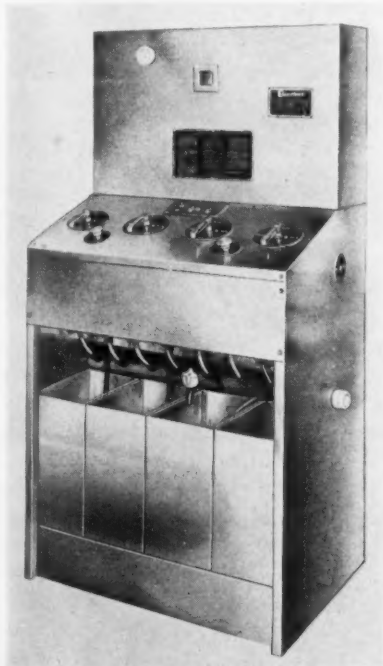
strong, welded steel base. Spindles turn in pressure-lubricated, self-aligning ball bearings. The start-stop push button is within easy reach, while the magnetic starter is out of the way. Lubrication of the pulley is easy. The motor is N.E.M.A. Standard, ball bearing, open squirrel cage, enclosed and protected by the steel base. Louvre doors afford easy access to the motor and provide adequate ventilation.

The variable speed arrangement greatly increases the flexibility of a polishing lathe and the range of products on which the machine will operate. By broadening its applicability, the useful working time is correspondingly extended and output increased.

Water Demineralizers

Barnstead Still & Sterilizer Co., Dept. MF, 161 Lanesville Terrace, Forest Hills, Boston 31, Mass.

Several significant developments in



the purification of water by de-ionizing are combined in Barnstead's New "Package-Unit" Upflo Demineralizers. Manufacturer claims these improvements result in, 1) Higher purity of effluent, 2) Lower cost per gallon, and 3) Simpler regeneration.

Higher purity is effected through the use of improved synthetic resins and by causing the raw water to flow up through the resin beds permitting more efficient use of the resins and, at the same time, more compact design.

Upflo operation also has an im-

If you're finishing parts with JUST PLAIN ZINC

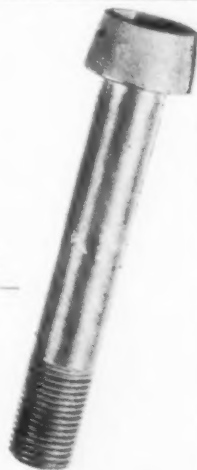
... better read this!

You've probably noticed that, despite today's grab-bag markets, more and more complaints are coming in on untreated zinc parts. Assemblers are demanding protection on all their zinc plate items — from refrigerator shelves to small tools; from fasteners to radio chassis.

So, for a protective treatment that will pass your customer's approval use Luster-on* inhibited zinc bright dip. Inexpensive, easy to use Luster-on* makes any zinc plate passive. A simple Luster-on* dip at the end of your plating line gives your product a finish that is permanently bright, rust- and corrosion-proofed — that even resists handling-smudges and finger-marks. Once your product is cold-dipped in Luster-on* there's no danger of spoiling its overall beauty or utility value.

If you're using ordinary zinc plating you certainly owe it to yourself to investigate Luster-on* further. First in its field, Luster-on* is first in results too! Send the coupon and a sample for processing today. No obligation!

THIS BOLT, with ordinary, untreated zinc plating, is dull — lusterless, subject to corrosion.



THIS IS THE SAME BOLT after a Luster-on* dip. The Luster-on* cost for permanent protection and bright finish — one-thirtieth of one cent! Bolt size 1/2" x 4".



WHICH BOLT WOULD YOU BUY?



Kemo says:

You can solder to a Luster-on* surface, too. Simply use our Never-Sever Solder Flux.

REG. U. S. PATENT OFFICE

THE Chemical CORPORATION

54 Waltham Ave., Springfield 9, Mass.

THE CHEMICAL CORPORATION
54 Waltham Ave., Springfield, Mass.

Please send me full particulars about Luster-on* bright dip for zinc-plated surfaces. I am (am not) sending sample for free dip. No obligation, of course.

Name _____
Firm _____
Address _____

Metal Finishing, May

New Method for Cleaning Stamped Aluminum Parts

Removal of stamping compound and other dirt from cup-shaped aluminum parts 3" and 4" diameter and 3" and 4" deep gave a Southern manufacturer a great deal of trouble. Various types

Magnus Aja-Dip Sr. Machines Offer You Materially Improved Cleaning at Much Lower Costs

Here is a line of cleaning machines with a capacity range of from 100 to 2,000 lbs. which offer you two major improvements on your metal cleaning operations.

First—the vigorous, positive agitation they provide by moving the work up and down IN the solution insures much *faster* cleaning than you can get by any other method.



Second—this repeated intimate contact of the solution with all parts of the work insures much more thorough cleaning than you get by ordinary means.

Magnus Aja-Dip Sr. Machines can be used with any of the specialized Magnus Cleaners needed for your particular cleaning jobs . . . such as Magnusol for pre-cleaning, Magnus 92S for aluminum and soft metals, Magnus 94XX for steel, or Magnus 61K and NXL for slushing oils.

If you are interested in improving the quality and speed of your metal cleaning, or if you are having problems in rejects or off-quality work in plating and finishing because of poor cleaning, it will pay you to study the Aja-Dip Sr. Machine Bulletin illustrated here. We'll be glad to send a copy.

of aluminum cleaners were used, but if they were used at strong enough concentration to remove the stubborn dirt deposits they had to contend with, too much damage to the aluminum took place.

We suggested that they try Magnus 755—the solvent emulsion cleaner which was developed during the war for removing hard carbon deposits from airplane engine parts. From the first, Magnus 755 worked out perfectly. Cups are cleaned completely in a ½-minute dip at room temperature, and there is no trace of damage or attack on the metal.

Today these cups are cleaned on the following plan: Three 200-gal. tanks are used, in line. The first tank contains #755 with 15% safety solvent. The two other tanks are for water rinsing. 50 to 100 cups are loaded in a wire basket and dipped in the #755 solution for ½ minute, with hard agitation. The basket is drained and then dipped successively in the two rinse tanks.

Work is perfectly cleaned, and the manufacturer's output is readily handled by this set-up.

If Removing Slushing Oils Gives You Trouble

You'll find it easy to remove slushing oils from metal parts if you use Magnus 61K with added NXL. This liquid alkaline cleaner, plus the added wetting action given by NXL, not only speeds cleaning, but greatly improves the quality of the job.

Magnus Chemical Company, 11 South Avenue, Garwood, N. J. In Canada — Magnus Chemicals, Ltd., 4040 Rue Masson, Montreal 36, Que. Service representatives in principal cities.

portant bearing on regenerating time since it completely eliminates the need for "Back-washing." Valve operations are reduced to a minimum, thus further lowering labor costs—by far the largest factor in deionized water costs.

Ease of installation is also stressed by the manufacturer. Unit comes completely assembled with everything in place. Valves, inter-connecting tanks are included. It is only necessary to connect to water supply and waste, to start operation. An ordinary electrical outlet is needed for the indicator lamp which tells when unit needs regeneration. No heat or electricity is used in the ion-exchange process itself.

New Unbreakable Acid Pail

Automotive Rubber Co., Dept. MF, 3601 Epworth Blvd., Detroit 4, Mich.

A new 5 gallon pail made of perforated steel with welded seams and covered, inside and out, with rubber



permanently wedged through the perforations is now being manufactured by the above firm.

This utensil is described as unbreakable and is designed for safer handling of acids and all corrosive solutions. It is shaped so that the top is no larger than that of the 3 gallon size to decrease likelihood of fluids splashing or spilling when carried. The bail or handle is completely rubber covered. A pouring lip is formed on the edge and a tipping handle is provided at the base to make pouring easier and safer.

This pail completes the company's line of acid handling utensils, which also includes a 3 gallon pail, measure in 2, 4 and 6 quart capacities, a 2 quart dipper and 10 inch funnel.

New Continuous Wheelabrator Tumblast

American Wheelabrator & Equipment Corp., Dept. MF, Mishawaka, Ind.

By utilizing the unique combination



IN METAL CLEANING IT'S

MAGNUS

CLEANERS • EQUIPMENT • METHODS

of tumbling and longitudinal travel of the work, the Continuous Tumbblast offers thorough cleaning and uninterrupted efficiency. No time is lost for starting, stopping, loading and unloading, as in the conventional type batch mill, since parts are fed into and discharged from the machine in a continuous flow.

Work to be cleaned is carried through the blast barrel on an endless apron type conveyor which constantly tumbles and cascades the pieces, thereby completely exposing all surfaces of every piece to the full effect of the abrasive blast from the overhead Wheelabrator unit.

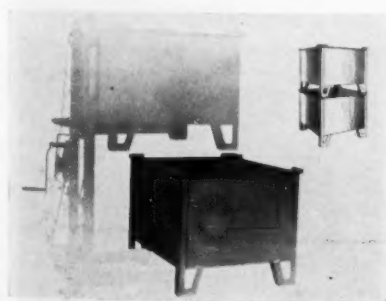
The rate at which the work progresses through the cleaning chamber is regulated by tilting the mill to the proper angle by means of jack screws. Since the speed of tumbling and the flow rate of work through the mill can be adjusted to suit the work, the speed of production and the quality of cleaning can be accurately controlled.

Details of construction and operating data are contained in Bulletin 514.

All-Steel Storage Bin

Palmer-Shile Company, 16035 Fullerton Ave., Detroit 27, Mich., Dept. MF.

Announced by the above firm is a new type of steel storage bin designed with a four-way entrance for use with a hand, power lift or fork truck. Can be tiered with a portable elevator, high lift or fork truck. Can be built with crane lugs for use with an overhead



hoist. Provides a most practical method for conveniently storing small parts in limited floor space.

Constructed of heavy steel plate with legs and corner reinforcements of angle iron. Sturdy corner plates for stacking. Top edge is flanged all the way around to give extra strength. Inside dimensions are length 36", width 36", depth 24". Weight approximately 210 lbs.

METAL FINISHING, May, 1948

Put the



on burnishing problems

No matter what your burnishing problems may be, you'll find the answers in the *complete* Wyandotte line of burnishing compounds.

Wyandotte Burnishing Compound 317 gives a high luster to parts of zinc, nickel and Monel metal. It works effectively in either hot or cold water. And because this viscous liquid contains no soap or inorganic alkalis, its burnishing action is not affected by the hardness of water. It rinses freely and leaves no scum on the work or in the barrel.

Wyandotte Burnishing Compound 320 gives a highly satisfactory finish to brass, copper, bronze, carbon steel or stainless steel. It is a soap-type compound and contains a non-toxic brightening agent. It may be used for burnishing with steel balls or for combined burnishing and burring with chips or stones.

Your Wyandotte Representative will be glad to tell you more about these and other specialized Burnishing Compounds in the *complete* Wyandotte line. All you have to do is give him a call.



WYANDOTTE CHEMICALS CORPORATION
WYANDOTTE, MICHIGAN • SERVICE REPRESENTATIVES IN 88 CITIES

Filter All Plating Solutions Faster, More Completely in

SPARKLER Horizontal Plate FILTERS

Because the filter cake is held horizontally, it is absolutely stable to the end of each filtering cycle. And cycles are longer because the cake retains its porosity longer. That is why the "horizontal principle," as embodied in Sparkler filters, gives you more efficient, low

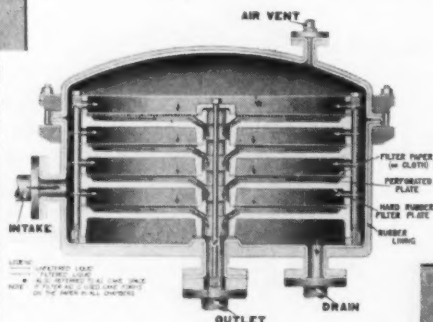
cost, operation. Sparkler filters are pressure-tight and leak-proof, designed for intermittent or continuous operation.

4 Plating Solution Types

1. Rubber-lined for bright nickel
2. Stainless steel for acids
3. All Iron for alkaline solutions
4. All Steel (with Stainless Pump) for chromium

SPARKLER MANUFACTURING CO.

Mundelein, Illinois



Made in Capacities
60 to 10,000 G.P.H.

See your supplier or
Write for details

Our Engineering Service
is available for any
specialized problems.

M.S.A. Coolband Provides Working Comfort on Hot Jobs

Mine Safety Appliances Co., Dept.
MF, Pittsburgh 8, Pa.

The M.S.A. Coolband is an efficient perspiration retainer designed by the above firm to provide greater comfort for men working on hot jobs.

Fitting comfortably all-around-the-head, the soft, sponge rubber Coolband constantly absorbs perspiration, creating a cooling effect. By preventing perspiration from dropping into the eyes and on glasses or goggles, the M.S.A. Coolband promotes better working comfort and efficiency. Light in weight, the Coolband clings gently to the head without binding. It may be



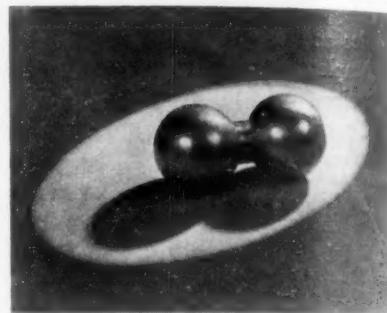
thoroughly cleaned by hand-squeezing in soapy water and may be sterilized by the same method, using customary germicidal solutions.

New Zinc Plating Anode

Udylite Corp., Dept. MF, E. Grand
Blvd., Detroit, Mich.

Introduction of a new "Twin Zinc Ball Anode" priced to give savings ranging up to 8.6 percent is announced by the above firm.

The twin unit is cast by a new high production method resulting in manufacturing economies which have been



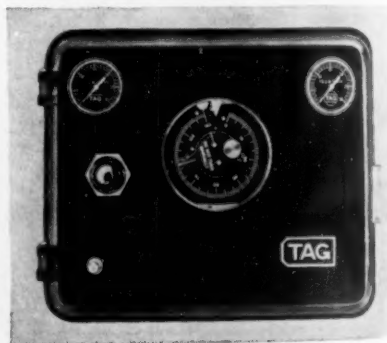
entirely passed along to Udylite customers, thus accounting for the new low price. Efficiency of the distinctively priced anode is unsurpassed, it is claimed.

Process Control Timer

C. J. Tagliabue Corp., Dept. MF, 614
Frelinghuysen Avenue, Newark 5, N. J.

The above company claims that their latest type time schedule controller is most practical, and can be synchronized with any system of air-operated semi-automatic temperature and pressure control now in use to make the process fully automatic.

Such an installation will enable manufacturers to obtain fully automatic



time schedule control at relatively low cost and without disposing of presently installed equipment.

In use, the operator begins the process by pressing the starter push button on the timer. A signal light above the button flashes on to indicate the process is under way. By means of an adjustable cam, timing begins immediately,

or, if desired, when the temperature has reached the processing point. This temperature is maintained for the predetermined length of time. All valves—steam, air, drain, overflow and cooling water—are operated as the process may require and all manual adjustments heretofore performed by the operator are eliminated. At the completion of the process, the signal light is extinguished, indicating visibility that the process cycle has been completed.

This highly practical instrument, with its entire mechanism housed in an attractive, rugged case, finds many applications in industries.

New Electric Unit for Pumping Acids from Carboys

Belke Manufacturing Co., 947 N. Cicero Ave., Chicago 51, Ill., Dept. MF.
Faster, safer and more convenient



removal of acids, alcohols, bleaches and other liquids from carboys is claimed possible with a New Electric Carboy Acid Pump.

Light weight and convenient handle afford exceptional ease in moving Belke Carboy Acid Pumps from one carboy to another. The pumps are furnished with a 110 V, 60 cycle, AC motor, and can be plugged into any standard electrical outlet.

As the Belke Acid Pump is slipped into the carboy the self-sealing rubber connection seals the carboy neck. Turning on the motor switch causes the compressor to build up air pressure in the carboy, quickly forcing a steady flow of acid out through the pipe.

The flow of acid can be stopped instantly by pressing the "flow stop" lever which releases the air pressure in the carboy. A pressure release valve pre-

PASTE



RACK INSULATION

No evaporation; not inflammable. All solids; no loss. Single coat gives thick and extremely tough coating which has long operating life.

SAVES LABOR—TIME—COST

New material. New method of handling. Requires baking to convert from Paste to solid. BUNATOL No. 1000 Paste Insulation has extra fluidity and handles fast without delays or trouble. Get the facts—low prices makes this available in any shop.

NELSON J. QUINN COMPANY

TOLEDO 7, OHIO

vents the air pressure from going over 30 lbs. The only part of the unit which the acid contacts is the pipe. It is easily replaceable and is available in lead, hard rubber or Saran.

Quadruple Plating Barrel

Daniels Plating Barrel and Supply Co., Dept. MF, 129 Oliver Street, Newark 5, N. J.

Announcement is made of a new quadruple plating barrel unit for bulk plating of small parts. The advantages of a plating barrel of this design are innumerable. It is ideal for production plating where segregation of parts is necessary, and it can be used for laboratory or experimental pur-

poses. It is a self-contained, compact apparatus occupying a minimum of floor space and is economical to install. The entire unit is operated by a single ratio motor drive.

Each plating cylinder is readily removed and is inter-changeable. Each cylinder is also independent of all others including separate sets of anode rods; therefore, it can be operated and controlled individually or all the cylinders can be connected in such a manner that they can be operated from the same circuit.

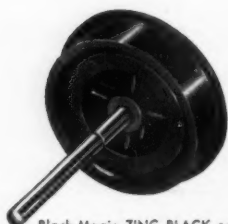
In the event that different types of solutions are required for experimental purposes, partitions can be installed between each cylinder; and each unit can be operated as desired.

The New **BLACK-MAGIC** Zinc Black Protects Important Parts

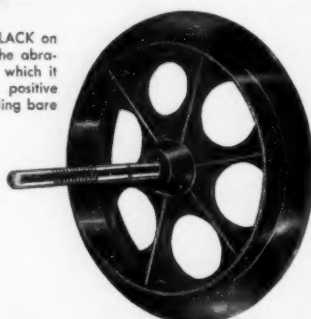
ON THE WEBSTER-CHICAGO WIRE RECORDER



Black-Magic ZINC BLACK is used on the spool of the Webster-Chicago Wire Recorder shown below because it does not build up the diameter and is a good bond for the silk screen painted trade name.

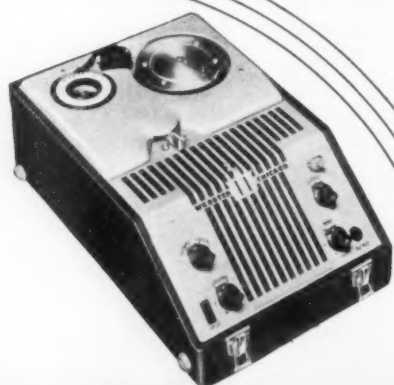


Black-Magic ZINC BLACK on the mandrel resists the abrasion of a felt brake which it engages, affording positive action without revealing bare metal.



Black-Magic ZINC BLACK, used on the take-up reel, resists the abrasion of the magnetic recording wire which rides on the periphery.

Write for the "Black Book" of details on our zinc black and other Black-Magic metal finishes. Also, for a first-hand acquaintance with this zinc black, suggest you send us a product for sample processing without obligation.



MITCHELL-BRADFORD CHEMICAL COMPANY
MODERN METAL FINISHES

• 2446C MAIN ST., (Stratford) BRIDGEPORT, CONN. •

BLACK-MAGIC OXIDE BLACKING SALTS
WITCH-DIP & WITCH-OIL FINAL FINISHES

CHICAGO OFFICE: 111 W. Jackson Blvd.



SILCO Glass-Base PROTECTIVE COATING
HEAT TREATING SALTS, CLEANERS, ETC.

This Multiple-Economy Unit has a multiplicity of application both for production plating or experimental purposes.

New Emulsifiable Solvent Cleaner

Oakite Products, Inc., Dept. MF,
22 Thames St., New York 6, N. Y.

A new emulsifiable solvent cleaner that dilutes with water for efficient cleaning of metal parts in pressure spray-type washing machines, has recently been announced by this firm.

Designed to solve difficult problems of large-scale production cleaning, Oakite Composition No. 97 forms water emulsions suitable for spray application in single or multi-stage metal washing machines.

Paramount among the reported fea-

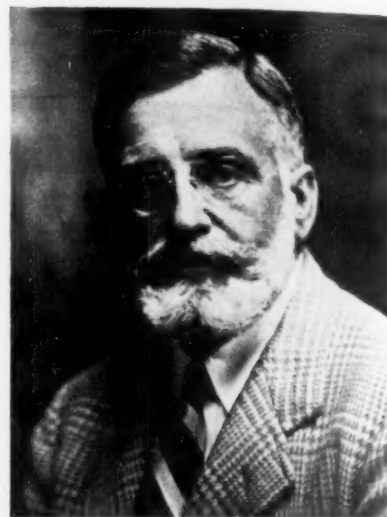
tures of Oakite Composition No. 97 are: (1) its surface-active agents speedily penetrate and loosen deposits so that they readily flush away under the impact of cleaning and rinsing sprays; (2) at recommended concentrations it shows no tendency to foam; (3) since the emulsions do not hold soils in permanent suspension, their effective life is prolonged and nozzle-clogging reduced; (4) a temporary rust-retarding film remains on work; (5) added to rinse water in small quantities, material minimizes water-spotting; (6) the water emulsions present no fire hazards and do not give off toxic vapors; (7) solid-particle dirt are effectively removed.

Additional information concerning this new material is available in a special free Service Report.

Business Items

H-VW-M Company Appoints New Officers

The Hanson-Van Winkle-Munning Company, Matawan, N. J., manufacturers of electroplating and polishing equipment and supplies, announces the appointment of officers at the Annual



Van Winkle Todd

Directors' Meeting held at Matawan, New Jersey, on April 15, 1948. The following changes were announced:

Van Winkle Todd, who previously served as President, was appointed Chairman of the Board of Directors.

Guerin Todd, former Vice President.



Louis M. Hague

was appointed Vice Chairman of the Board.

Louis M. Hague, former Vice Presi-

dent. was appointed President.

John A. Bauer, former sales manager, was appointed a Vice President, assuming many of the duties for which Mr. Hague was previously responsible.

All of the above-listed officers have been with the Company 20 years or more.

Van Winkle Todd became associated with the Hanson & Van Winkle Company in 1912 and was its President at the time of its consolidation with A. P. Munning & Co., in 1927, to form the Hanson-Van Winkle-Munning Company of which he has served as President since that time. He will continue to maintain an active participation in the affairs of the company.

Louis M. Hague, the new President, has spent most of his life in the electroplating industry. He was born in Pittsburgh where both his grandfather and his father operated electroplating plants. He joined the staff of the Hanson-Van Winkle-Munning Company in 1928. Mr. Hague has served successively, in various sales and service capacities, and since 1939 he has been a Director and Vice President in charge of sales.

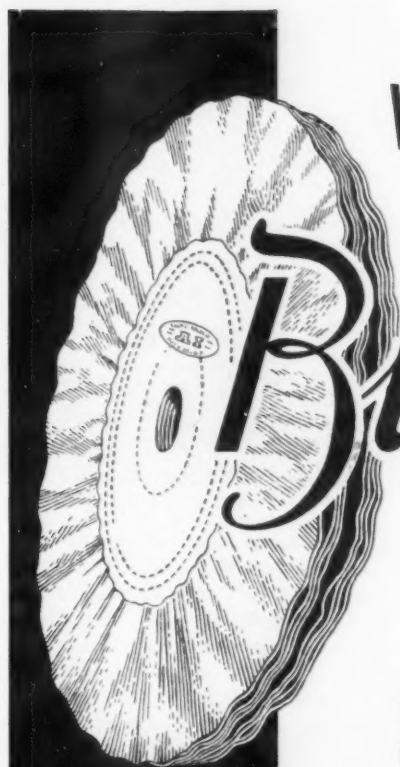
The Hanson-Van Winkle-Munning Company is one of the largest organizations in the world devoted exclusively to the manufacture of equipment and supplies for the electroplating and metal polishing industries. It was founded originally, as the Hanson & Van Winkle Company in Newark, N. J., in 1820. The present company is the outgrowth of a merger in 1927 of the Hanson and Van Winkle Company and A. P. Munning and Company. The latter company was formed by members of the George Zucker Company of Newark, N. J., and the Munning-Loeb Company of Matawan, New Jersey.

Hieland Heads Research for Metal-Clean

The Metal-Clean Solvent Corp. of Chicago announces the addition of Mr. John Hieland to its staff. He will be in charge of research and development work for the corporation. Mr. Hieland comes to Metal-Clean with years of valuable experience, having formerly been with Bell and Howell Co., Buick Motor Car Co., Aviation Division, and the Pure Oil Co.

Gerhart Eastern Manager for Metal-Clean Solvent Corp.

The Metal-Clean Solvent Corpora-



WILLIAMSVILLE

Buffs



WHATEVER your metal finishing problem, you will find a Williams-ville Buff to economically speed the operation. Or we will create one to especially meet your individual requirements, if desired.

**QUALITY—DURABILITY
SINCE 1893**

**The WILLIAMSVILLE BUFF MFG. Co.
DANIELSON, CONNECTICUT**

tion announces the appointment of Mr. Ernest Gerhart as eastern regional manager. Mr. Gerhart was formerly metallurgist contact representative of the U. S. Steel Corporation; chief metallurgist of the Reliance Division of the Eaton Mfg. Co. and more recently, chief metallurgist of the Ingersoll Steel Division of the Borg-Warner Corporation. He will make his headquarters at Metal-Clean's home office, 1935 N. Paulina St., Chicago, Illinois.

Sam Tour Laboratories Expands Facilities

The firm of Sam Tour & Co., Inc., engineers, metallurgists, consultants, is expanding its laboratories and workshops to better handle the increase in

the volume of its business.

Two and a half floors of additional space, in its building at 44 Trinity Place in downtown New York, are being taken over by the firm as the tenants move out.

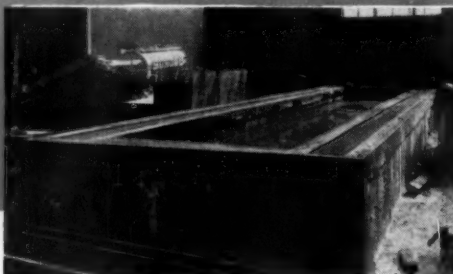
When the transition is completed, seven floors of this building will be occupied completely by this organization.

Teeling Promoted by Raybestos-Manhattan

Richard F. Teeling of Alps Road, Preakness, N. J., was recently appointed Manager of North Jersey Branch of Manhattan Rubber Division of Raybestos-Manhattan, Inc., Passaic, New Jersey. Mr. Teeling has been

TANKS and FLOORS UNIMPAIRED by CORROSIVES

used in
Cleaning
and Finishing



This DUAL CONSTRUCTION tank is part of a large battery of Atlas acid-proof equipment in plant of a prominent Eastern galvanizer.

Sulphuric employed in preparation, chromic used in finishing — are just two of many corrosives that have no deteriorating effect upon Atlas construction. Whatever types of acids, alkalis and other solutions your production calls for, they can be handled safely with long-lived Atlas units. In addition, Atlas construction withstands temperatures as high as 360° F. Atlas Materials include acid-proof brick, cements and linings. Atlas Design includes patented DUAL CONSTRUCTION, which saves time and labor, makes units ready for service almost at once — and permits handling of solutions at boiling temperatures. Atlas units range from pickling tanks 300' and more in length down to platers' portable tanks, built at our plant and shipped out by rail or truck. Atlas Floors have extraordinary resistance to mechanical punishment, and they stay smooth, developing no ruts or high spots due to chemical action. Study of your acid-proofing problems — and recommendations, plans and estimates may be had without obligation. Contact our nearest branch—and write Mertztown Office for Bulletin TS-D.

THE Atlas Mineral

THE ATLAS MINERAL PRODUCTS CO. OF TEXAS INC., Box 252, Houston 1, Tex.
• BIRMINGHAM 2, Calif., 605 Addison St.
• DALLAS 5, Tex., 3921 Purdue St.
• DENVER 2, Colo., 1921 Blake St.
• HONOLULU 2, Hawaii, U. S. A.
• OMAHA, Neb., 423 South 18th Ave.
• LOS ANGELES 12, Cal., 1725 Central Ave.
• SEATTLE 4, Wash., 1252 First Avenue, S.
*Stock carried at these points

IN CANADA: Atlas Products are manufactured by H. L. BLANCHFORD, Limited, 977 Aqueduct Street, Montreal, P. Q., 86 Bloor St. W., Toronto, Ont.

Products Company of Penna.

MERTZTOWN PENNSYLVANIA
• ATLANTA 3, Ga., 452 Spring St., N. W.
• CHICAGO 1, Ill., 333 No. Michigan Ave.
• DETROIT 2, Mich., 2970 W. Grand Blvd.
• NEW YORK 16, N. Y., 280 Madison Ave.
• PITTSBURGH 27, Pa., 4921 Plymouth Rd.
• PHILADELPHIA, Pa., 355 Fairview Rd.
• SPRINGFIELD, Pa.
• ST. LOUIS 8, Mo., 4485 Olive St.



Richard F. Teeling

associated with this concern for 38 years, serving as Assistant Manager for the past 8 years.

Alvey-Ferguson Appoints Chicago Representative

The De Greener Corporation, Chicago, has become the representative in the greater Chicago area for The Alvey-Ferguson Company, Cincinnati, Ohio, manufacturers of washing machines for industry, according to Donald P. Smith, sales manager of that division.

The De Greener Corporation will further extend the sales facilities of The Alvey-Ferguson Company and assure prompt assistance to industries in the Chicago area.

Michigan Chrome Appoints F. E. Jones

F. E. Jones has been appointed sales representative for the Eastern Central states by Michigan Chrome & Chemical



F. E. Jones

Co., 6340 E. Jefferson Avenue, Detroit 7, Mich. He will represent the complete line of Miccro products—rack coatings, stop-off lacquers and corrosive resistants for the plating industry, covering the states of Ohio, Kentucky, West Virginia, western Pennsylvania, western New York State and Canada.

His previous connection was with the Veterans Administration as a training specialist, supervising the training, in metal trades, of veterans studying and working under the G. I. Bill in the Detroit area.

He has been associated with the sales department of Greenfield Tap and Die Corp., in the Chicago area, and was district manager of sales for the General Implement Company of America, covering the mid-western states.

Mr. Jones attended Wayne University, majoring in Business Administration.

Cunningham Appointed Representative for Harrison Compounds

Harrison & Co., Inc., Haverhill, Mass., manufacturers of Harrison 4-A Buffing and Polishing Compounds, announce the appointment of Gheen Cunningham as Technical Representative.

Cunningham, a University of Pennsylvania graduate, is well grounded in the buffing and polishing field having spent 5 years with Du Pont as a technical field representative, was

general foreman of a cutlery factory and also served as supervisor of mirror-finishing and polishing departments.

With Harrison, Cunningham will be



Gheen Cunningham

available for technical assistance on problems pertaining to polishing, compounds and cement.

Lupomatic Adds to Laboratory Staff

Lupomatic Industries, Inc., announces the appointment of William Di Leo to the plastics section of its research, testing, and service laboratory. He is to exploit the many Lupomatic improved processes for tumbling plastic parts to a high, lustrous finish.

Mr. Di Leo has had many years of experience with plastic manufacturers and fabricators in creating more effective combinations of compounds and carriers to insure quality control of finishing operations through tumbling.

Mr. Di Leo's engagement marks a further expansion of Lupomatic Industries, Inc.'s policy of greater research in the science of tumbling equipment, compounds, and processes, and to materially improve the finishing techniques on plastics, metals, wood, and rubber parts.

Roland Mueller Joins Allied Finishing

Roland H. Mueller, formerly assistant Chief Chemist at Bell & Howell of Chicago, has joined the laboratory staff of Allied Finishing Specialties Co., 2639 W. Grand Ave., Chicago. The Allied firm is one of the larger midwest manufacturers making a complete line of industrial coatings.

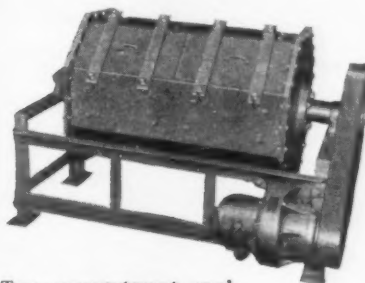
Mr. Mueller received his degree in

A TUMBLING BARREL FOR EVERY PURPOSE

Yes . . . Henderson can supply you with tumbling equipment in a variety of sizes, shapes and materials for practically every tumbling requirement. Nearly three quarters of a century in designing and manufacturing tumbling barrels for the GRINDING, BURNISHING, POLISHING and CLEANING of metal stampings, balls, bearing races, forgings, small castings, screw machine products, jewelry, wire forms and small metal parts. Tilting type barrels of Steel, Wood or Alloy Metal . . . Horizontal type barrels of Cast Iron or Cast Steel. Wood or rubber lined in all Models. Also special barrels for plastics.



#5A Motor Driven Tilting Oblique Tumbling Barrel.



Two-compartment wood-lined Burnishing Barrel.

If your requirements call for faster production and finer quality at lower cost or if you require Tumbling Barrels of special design, our Development and Engineering Service will be glad to make recommendations.

Write for further information.

Since 1880 - Designers and Builders of Tumbling Barrel Equipment

THE HENDERSON BROS. COMPANY

135 SOUTH LEONARD ST. WATERBURY 85, CONN.

Engineering Science from the Armour Institute of Technology. His new duties will include the testing of raw materials and finished products, formulation of new and improved products and general technical advice on finishes and finishing problems.

He was with Bell & Howell for six years.

C. F. Gurnham Enters Consulting Field

His entry into the consulting field has been announced by Mr. C. Fred Gurnham, Ch. E., of 72 Lake St., Hamden 14, Conn. Mr. Gurnham will specialize in metal finishing, chemical manufacturing, and waste disposal work.

Mr. Gurnham holds a Doctor's Degree from New York University in Chemi-



C. Fred Gurnham

TICKETS

all One Price

ONE SOLVENT FOR ALL METALS OR COMBINATION OF METALS

NEW SCIENTIFICALLY IMPROVED BLACOSOLV

ALUMINUM
COPPER
BRASS
PRECIOUS METAL
STEEL

FOR SOLVENT VAPOR DEGREASERS

Write today for **FREE** booklet on Degreasers and application with Blacosolv the all purpose degreasing solvent.

G. S. BLAKESLEE & CO.
G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y. TORONTO, ONT.

BLACOSOLV
DEGREASERS AND SOLVENT

NIAGARA
METAL PARTS WASHERS

cal Engineering, and is a licensed professional engineer for Conn., and New York. He has had wide experience in the metal finishing field, and is at present Vice-Chairman of the Research Directing Committee of the American Electroplaters Society, and Chairman of that society's research in Plating Room Wastes.

For the past several years he has been connected with the firm of Whitney-Blake Co., of New Haven, Conn.

Mathieson Alkali Changes Corporate Name

The Mathieson Alkali Works, 60 E.

42nd St., N. Y. C., after having been known by that name for 56 years, announced that its stockholders had approved a change in name to *Mathieson Chemical Corporation*. The company was established in 1892, when a group of American businessmen decided to produce alkali and bleaching powder in this country.

From that beginning the company has grown to its present size with plants at Saltville, Va., Niagara Falls, N. Y., and Lake Charles, La., having a capacity of over 600,000 tons of basic chemicals annually.

Almost immediately after starting operations at Saltville, the company obtained the right in this country to the use of the Castner electrolytic cell for producing caustic soda and chlorine. After experimental installations were tested at Saltville, a plant was built at Niagara Falls, N. Y., where the abundant, low-cost power needed for the process was available. This plant was operated at the Castner Electrolytic Alkali Company until 1917 when it was merged with the parent company.

In 1923, Mathieson introduced synthetic ammonia, the first commercially produced in the United States.

Wyandotte Adds Four Industrial Service Men

Wyandotte Chemicals Corp., Wyan-



Roscoe K. Martin



Eldon B. Hunt

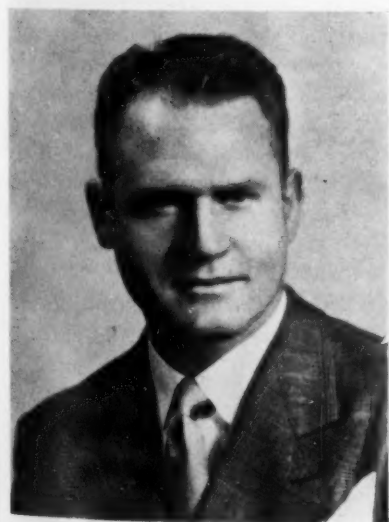
dotte, Mich., has recently placed additional Industrial Service Representatives in the Cincinnati, Grand Rapids, Indianapolis and Pittsburgh offices of the company. All were assigned to their territories following intensive training at the Wyandotte Technical Service Laboratories and practical field work covering the various phases of metal finishing in several manufacturing centers. Wyandotte Service Representatives are located in 88 North American cities—many of them are specialists in metal cleaning.

Roscoe K. Martin, Cincinnati, has completed advanced studies at the University of Dayton and has been a test engineer, chemist and plating analyst for Allison Division of General Motors and for Wright Field.

Eldon B. Hunt, Grand Rapids, is a chemical engineering graduate of Michigan State College. He has done experimental work in heat treating for



John E. Vaughn



Harry L. Flister

CHROMIC ACID

99.75% PURE

With two complete, independent plants at Jersey City and Baltimore, and over a hundred years of technical background, Mutual is the world's foremost manufacturer of Chromic Acid.



Bichromate of Soda
Bichromate of Potash

**MUTUAL CHEMICAL COMPANY
OF AMERICA**

270 MADISON AVENUE

NEW YORK 16, N. Y.

Oldsmobile and in electronics for the Navy.

John E. Vaughn, Indianapolis, is a chemical engineering graduate from University of Kansas. He has been a development engineer for U. S. Rubber, a chemist for Seagram and an inspection officer for the Navy.

Harry L. Flister, Pittsburgh, is a graduate of the University of that city, and was employed by U. S. Steel following active service with the Navy.

Pennsalt Announces Five Research and Development Personnel Appointments

Five new personnel appointments in the Research and Development Department of the Pennsylvania Salt Manufacturing Co., including that of *J. Philip Evans* as Assistant to *S. C. Og-*

burn, Jr., Manager of Research and Development, were announced by the company recently.

Mr. Evans, who joined Pennsalt in 1942, was Senior Electrical Engineer in the company's Central Engineering Division at the time of his new appointment. Mr. Evans is a graduate electrical engineer of Pennsylvania State College. He is a board director of the Philadelphia Chapter, Pennsylvania Society of Professional Engineers.

The other new additions include *Clifton R. Neumoyer*, Senior Research Chemist in the Research Division; *Harold L. Warner*, Associate Patent Attorney, Patent Division; *Joseph Simkin*, Research Chemist, Special Products Division; and *Charles A. P. von Hemert*, Junior Chemical Engineer, Development Division.

Reduce your overhead
... effectively
control fumes



Niehaus Fume Separator

● Niehaus Fume Separators will reduce your overhead two ways . . . overhead expenses and space-consuming overhead ductwork. By water absorption and centrifugal separation, it will effectively control the fumes from your cleaning and plating solutions.

The complete unit is located alongside your tank . . . no expensive blowers or long ducts are required. No air is discharged outside.

For complete specifications and information on how the Niehaus Fume Separator eliminates costly equipment, reduces installation costs, and sells for less. Write for illustrated folder.

See a Niehaus Fume Separator in operation in Booth 11 at the A.E.S. Exposition in Atlantic City, June 28 to July 3. The new Niehaus Dust Control Unit also will be shown for the first time.

INDUSTRIAL ELECTROPLATING COMPANY, INC.

219 West Vermont Street, Indianapolis 4, Indiana

Dr. Neumoyer graduated from Lehigh University in 1938 with a bachelor of science degree in chemical engineering and later earned master of science and doctor of philosophy degrees in chemistry at the same university. He comes to Pennsalt from the Heyden Chemical Corporation, Garfield, N. J.

Mr. Warner is a graduate of American University, Washington, and received his law degree, at the Georgetown Law School, Washington.

A graduate of Temple University with bachelor of science and master in education degrees, Mr. Simkin was previously associated with the Research

Section, Industrial Test Laboratory, at the Philadelphia Naval Base. Mr. von Hemert is a recent graduate of Princeton University with a bachelor of science degree in chemical engineering.

Dr. Kinzel Heads Union Carbide Research

The election of *Dr. A. B. Kinzel* as President of Union Carbide and Carbon Research Laboratories, Inc. has been announced by *William J. Priestley*, Chairman of the Board.

Dr. Kinzel graduated from Columbia University, A. B., in 1919, Massachusetts Institute of Technology in

General Engineering, 1931, and the University of Nancy, France, D. Met. Ing., 1922, where he also received the degree of Doctor of Science.

He is the author of many papers on the testing and welding of metals, on the metallurgy and physical chemistry of steelmaking, on the composition, physical properties and use of ferro-alloys and alloy steels, and on applied mechanics, and is co-author of the volumes on chromium on the "Alloys of Iron" series of monographs. He holds many patents in these fields.

Dr. Kinzel has headed many important committees of various technical societies, and is now Director of the American Welding Society, Director of the American Institute of Mining and Metallurgical Engineers, and Chairman of the Engineering Foundation Board as well as Chief Consultant in metallurgy to the Los Alamos Laboratories and the Argonne National Laboratories of the Atomic Energy Commission. During the war, Dr. Kinzel was Senior Consultant on Metals for the War Production Board.

Manufacturers' Literature

Steam and Water Mixer Catalog

Sarco Co., Inc., Dept. MF, Empire State Bldg., New York 1, N. Y.

A new steam and water mixer to provide hot water at isolated points is described in Catalog 900. Eliminates piping of hot water long distances or installing separate heaters in remote wash rooms or showers. Takes up little space and delivers hot water at your pre-determined temperature. In 2-colors, the cut-away photographs show operation, installation, and construction. Convenient capacity and dimension tables are included. Ask for Catalog 900.

Dry Pickling Agent

Waverly Petroleum Products Co., Dept. MF, Drexel Bldg., Phila. 6, Pa.

The above firm has issued a new catalogue describing their Troxide pickling agent. This material is supplied as a dry compound which becomes active when dissolved in water. In the dry state the material is non-corrosive and safe to handle, and when

dissolved in water it becomes an effective pickling agent for steel and copper-base alloys. Incorporated in the mixture is a foam-producing agent that keeps acid mists from rising and creating an occupational hazard.

The catalogue gives pickling curves showing the loss of metal in various pickling baths, and includes a lot of practical information on the pickling of various metals, with formulas for various strips and bright dips. Copies may be obtained by writing to the company at the above address.

Rectifiers and Controls

General Electric Co., Dept. MF, Appliance & Merchandise Dept., Bridgeport 2, Conn.

A 28-page illustrated booklet on General Electric's complete line of copper-oxide rectifiers and controls for electroplating, anodizing, electrocleaning, electropolishing and other electrolytic processes has been announced by A. L. Scaife, advertising manager of the company's Appliances & Merchandise Department.

The booklet explains the advantages of unit installation of rectifiers over the old central power supply system and points out the advantages of the G-E "package power," which offers flexible, low-cost power and control equipment tailored to fit all modern plating and anodizing requirements. Technical diagrams and tables listing the complete range of packages for both manually and automatically controlled rectifiers and what they will do are also given.

As an aid to manufacturers in their planning, the publication carries illustrations of typical installations of G-E rectifiers and controls.

Wagner Issues Folder on Zinc Anodes

Wagner Bros., Dept. MF, 427 Midland Ave., Detroit 3, Mich.

A new folder, die cut in the distinctive shape of their recently-introduced Flat Top anode, has been released by the above firm. The two-color four page folder describes six advantages of the new zinc anode, principally the shape which eliminates possible confusion of zinc with cadmium or tin anodes. Folder provides for imprinting with names of qualified metal-finishing supply houses, as nationwide distribution is planned. Copies are available by writing Wagner Brothers at the above address.

Coating 218

8 MONTHS
... and still going strong!

Former Coating

2 WEEKS
... and "all washed up"!

Unichrome Coating 218 delivers record service on rack

A WELL-KNOWN MANUFACTURER gave Coating 218 their most severe practical test—protecting a rack in their lead plating bath. The solution operates at about 220°, contains nearly 27 ounces of caustic per gallon. Yet even after 8 months of this, Coating 218 shows only slight loss of resilience, is still as smooth as the day it

was put on the rack. Former rack coatings were wrecked *within 2 weeks!*

An unusual case? No, for you can depend on Coating 218 in *any* plating cycle. This 100%-solids synthetic bakes into an elastic, scuff-resistant, chip-proof coating which resists all plating and cleaning baths. Learn how you can save time and money with it. Write for bulletin RC-1.

(If you have no baking oven, write us for the name of a local applicator who will coat your racks with 218)



RACK COATINGS—Products of

UNITED CHROMIUM, INCORPORATED • 51 E. 42nd St., New York 17, N.Y.
Detroit 7, Mich. • Waterbury 96, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 13, Cal.

Low Temperature Fusible Alloys

Gerro de Pasco Copper Corp., Dept. C-2, 40 Wall St., New York 5, N. Y.

The above firm has just published the first few sheets of a series containing valuable information and illustrations on the applications and uses of their low-temperature-melting alloys. These sheets in convenient loose-leaf form, and others that will be published later, will be sent on request to interested companies.

Sheepskin Discs and Wheels

Divine Bros. Co., Dept. MF, 200 Seward Ave., Utica, N. Y.

A new illustrated bulletin covering Sheepskin discs and wheels has just been issued by this company. This bulletin gives valuable specification data, recommended uses, and the various

forms available for publishers' use. The different qualities of sheepskin are also discussed.

Copies of this bulletin may be obtained by writing to the above address.

News from California

By Fred A. Herr

New Plant for Rectifier Corp.

The International Rectifier Corp., now occupies a new plant building at 6809 S. Victoria Ave., Los Angeles, in which some 5,000 square feet of production area are available.

The facilities in the new plant are especially adapted for the manufacture of plating rectifiers for heavy duty applications. The main building is a one-



story brick structure. The principal manufacturing operations are conducted here as well as administrative and office functions. A separate smaller building, with 800 square feet of floor area, adjacent to the main building, is used for research work.

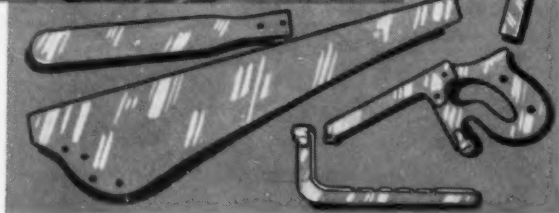
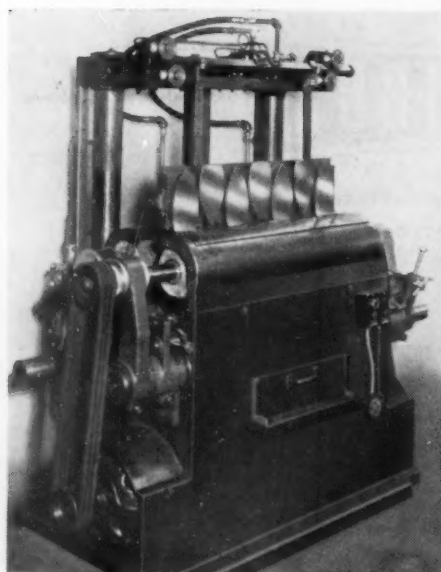
International Rectifier Corp., was organized in September, 1947. Officers are *Eric Lidow*, president; *G. H. Folsom*, vice president; and *Leon Lidow*, secretary-treasurer. The firm also specializes in colormetric equipment for special applications and for general colormetric analysis.

The *P & G Mfg. Co.*, operated in North Hollywood by *Paul Gruber*, in March opened a new \$15,000 plating department which has been outfitted with new equipment. The firm opened a new polishing department last December.

New equipment installed to handle the finishing of builders' hardware includes a complete setup for alkaline nickel, including an 800 gallon nickel tank, 500 gallon copper tank, cleaning tanks, generators, etc.

General Water Heater Corp., Burbank, Calif., has modernized its metal finishing department for water heater parts by the installation of two semi-automatic polishing heads, with which the polishing of aluminum water heater tops is handled.

"*Carload Andy*" *Ospring* of the *Sundmark Supply Co.*, Los Angeles, reports the completion of a new building for job shop plating work by *Albert Crum*, owner of the *Keystone Plating Co.* in North Hollywood. The building has been equipped with zinc, cadmium,



Look.....

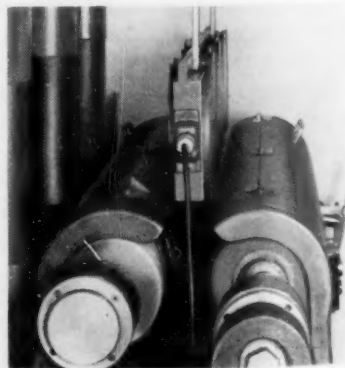
FAST and SIMPLE WAY of FINISHING FLAT IRON BASES

Economical mass production finishing on flat or near flat surfaces is easily attained in your plant with the improved Central Model 4 Hydraulic Polisher and Glazing Machine. Equipped with automatic pressure, speed control and instant stroke adjustment.

Designed for safe loading from either end this machine will accommodate a variety of large and small pieces such as saws, slicers, knives, hardware and other flat surfaces.

Write for Bulletin No. 16

- KNIVES
- BLADES
- SCRAPERS
- WRENCHES
- HACK SAW FRAMES
- FLAT IRON BASES
- SKATES



CENTRAL MACHINE WORKS, INC.

WORCESTER 8, MASSACHUSETTS

DESIGNERS OF FINISHING MACHINES SINCE 1920

copper, bright copper, bright nickel and silver tank facilities, polishing units and complementing equipment.

Sterling Top & Cabinet Co., has installed considerable new equipment in its plant at 2817 Empire Street, Burbank Calif. The shop is housed in one of the Lockheed Aircraft Company's wartime buildings. *Don Rodenbaugh*, company head, has added a flexible polishing setup for polishing stainless steel sinks and kitchen cabinets. He uses flexible shaft polishing equipment to achieve a distinctive stainless steel finish.

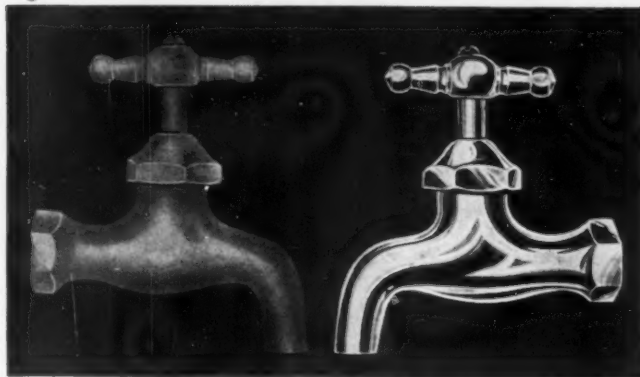
Globe Products Mfg. Co., Los Angeles, has taken over from U. S. Electrical Motors, Inc., of that city the manufacturing rights to the Autostart line of buffers and grinders. In mid-April production was fairly well along at the 3380 Robertson Ave. plant, *R. E. Lockhard*, sales manager, reported.

Cannon Electric Development Co., Los Angeles, is erecting a new \$70,000 plating plant to handle the chrome plating required for parts to be produced by the firm under a 1½ million dollar contract recently signed with Ford Motor Co. The contract provides for automotive decorative parts, which the Cannon Company proposes to diecast in its own plant. Work to be turned out under the Ford contract includes automobile door and window handles, instrument panel molding, miscellaneous knobs for instrument panels and other parts of Ford cars.

The metal finishing industry of California shares substantially in the *Ford Motor Car Company's* expanded activities on the West Coast, a total of 31 California firms having been awarded contracts to provide Ford parts. Among these are the following in the Los Angeles area:

Plomb Tool Co., Hollister Coil Spring Mfg. Co., Oliver Processing Co., National Gear Corp.; Osbrink Mfg. Co., American Industrial Development Co., Hercules Forge Co., Plastic & Rubber Products Co., all in Los Angeles; and Bendix Aviation Corp., North Hollywood; Emore Engineering Co., Alhambra; P. E. B. Mfg. Co., Burbank; Arturus Mfg. Co., Venice; B. H. Hadley Machine Co., Pomona; and Automatic Parts Co., Pico.

BRILLIANT LUSTROUS DEPOSITS WITHOUT COLOR BUFFING ...AN IDEAL BASE FOR CHROMIUM



NEW IMPROVED *Lustrebright* Bright Nickel Process

Produces Brilliant, Lustrous, Adherent Nickel Deposits •
Eliminates Color Buffing — Re-Cleaning — Re-Racking • An
Ideal Base for Chromium • Excellent Throwing Power •
No Special Solutions or Changes in Equipment Required •
Easy to Control • Low in Cost • Successful • Practical.

Gives uniform results and continuous operation on all classes of work in still tanks and mechanical barrels. Substantially reduces plating costs. Brilliant, lustrous, nickel deposits that may be chromium plated, are produced by merely adding NEW IMPROVED LUSTRE-BRIGHT to your present cold or lukewarm nickel solution.

Work comes from plating tanks with bright, fine grained, adherent deposits. No color buffing or burnishing is required. Work may

be transferred direct from nickel to chromium bath, without intermediary buffing, re-cleaning, or re-racking. Excellent for zinc die-castings.

GUARANTEED NOT TO HARM PLATING SOLUTION. Will not cause plate to peel, become brittle, or produce streaky deposits. Illustration shows unbuffed deposits produced before and after addition of NEW IMPROVED LUSTREBRIGHT. Write for complete information.

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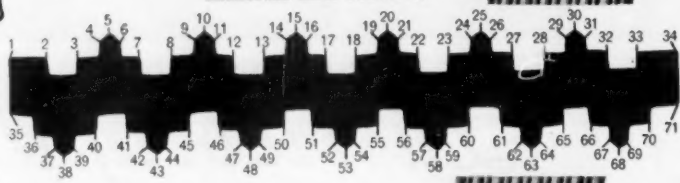
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Extra Throwing Power makes the Big Difference



71 throwing edges — plus 15.5 square inches of surface per inch of length — give Divco Lead Anodes the throwing power that speeds chrome plating — produces more uniform deposit — and saves time, material and current.



DIVCO 71-POINT LEAD ANODES retain the extra throwing power through a tremendous service life. The patented point pattern concentrates gassing and produces self-scrubbing action that sweeps the surface clean and eliminates stagnation.

Yet pound for pound Divco 71-Point Anodes cost no more. Equip a tank and compare results.

Order from your Plating Supply Jobber or direct. Merely specify size of bus bar and distance from top of bus bar to bottom of anode.

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Conforming Anodes



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Copper Wire

Bare copper wire in coils or spools in all gauges for plating use. Prompt shipment. Catalog No. 60 on request.

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Associations and Societies

AMERICAN ELECTROPLATERS SOCIETY

35th Annual Convention

The 35th annual convention of the American Electroplaters Society will be held at Atlantic City, N. J., on June 28-29-30 and July 1, 1948. Headquarters for this year's meeting will be the Ambassador Hotel. In addition to the Technical Sessions there will be an Industrial Finishing Exposition at the Convention Hall where manufacturers and suppliers of metal finishing equipment will display the latest types of equipment and processes. Another feature of this year's meeting will be an exhibit of plated ware by the various branches showing many new and novel finishes developed by branch members. Awards will be made for those finishes judged best in the exhibit.

An elaborate program has been arranged for the Ladies, and the annual International Fellowship Club activities will take place, including the annual golf tournament. The Annual Banquet and Entertainment will conclude the Convention on the closing night.

A complete program will appear in the June issue of *Metal Finishing*.

Registration

Registration for rooms must be made direct with the hotel.

How To Get There

For those living within driving distance of Atlantic City, the beautiful ride along the Jersey shore will prove the pleasantest means of travel, but for the less fortunate people who don't live in God's country, your committee has made arrangements for your railroad trip as follows:

Through your local Branch Secretary, arrangements can be made with the nearest Pennsylvania Railroad Passenger Representative to provide a special car direct to Atlantic City, providing at least 15 people wish to travel together from the cities listed below. This is a wonderful opportunity for the members to renew old acquaintances and have a good time en-route. The railroad agents have been instructed through the Central office to co-ordinate all the reservations, and they will

co-operate fully with the local Branch officers.

For the youngsters, either in age or spirit, there is also direct airline flights to Atlantic City from Philadelphia, Newark, LaGuardia Field, and Washington airports.

Arrangements for special railroad cars should be made well in advance with the local Pennsylvania RR agents.

Indianapolis Branch

The Annual Educational Session of the Indianapolis Branch of the A. E. S. will be held at the Indianapolis Athletic Club on Saturday, May 22nd. The lecture program will begin at 2 p.m. and will feature the following speakers:

H. J. McAleer, Formax Mfg. Co., Detroit, Mich. "Practical Facts on Polishing and Buffing Compounds and Wheels."

Walter Moline, National Cash Register Co., Dayton, Ohio. "Electropolishing."

Paul E. Miller, Miller Electroplating Co., Evansville, Ind., "An Incentive Plan for Job Shop Plating."

Following the educational lectures and discussions, the Annual Banquet will be held, starting at 7 p.m.

Mr. Quentin O. Shockley is the General Chairman, and *Dr. A. M. Max* will act as Technical Chairman for this annual affair.

Los Angeles Branch

The 18th annual Educational Session of Los Angeles Branch of the American Electro-Platers' Society was held March 20 at the Los Angeles Breakfast Club, with an attendance of 175 at the morning and afternoon technical sessions, and in excess of 400 members and guests at the banquet and ball in the evening.

The new attendance records—all-time highs in both instances—reflected the substantial increase in the branch's membership which during the past year passed the 200 mark to establish Los Angeles Branch as the fifth largest in the Society.

The morning business session opened at 9:30 o'clock with a welcome by Branch President Howard Woodward. The first speaker was *Walter L. Pinner* of the Houdaille-Hersey Corp., and 1945 president of the Supreme Society, who presented a talk on European procedures of plating and production from



10 to 1

You're Paying the Price... Why Not Have Efficient DC Power?

Wagner-Tiedeman Electroplating Rectifiers offer you really efficient DC power, definite advantages, at low all 'round costs. If you get all the following features in your present or contemplated power source—it's a Wagner-Tiedeman installation:

- 1 FLEXIBILITY**—Simple installation, easily expanded or shifted... Quickly replaceable without shop tie-up.
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- 3 OPERATING ECONOMY**—Low voltage high amperage Direct Current from Alternating Current source at lower cost than others.
- 4 MAINTENANCE ECONOMY**—Low velocity fans only moving parts; require only occasional compressed air cleaning... No special service men.
- 5 SERVICE ECONOMY**—Fans, transformers and stacks serviced by anyone... Everything visible... 24-hour factory parts delivery.

Cells will handle momentary overload up to 1000% of normal. Over 4300 sq. in. effective rectifying area. Three 40-watt cooling fans. Two-winding transformer. 6v at 1500 amp; 12v at 750 amp. Write today for our new engineering memorandum for full specifications and operating details.

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Give positive polishing action on light contour and radius work where resilient action is necessary.

FLEXIBLE—They mold the belt to the work surely and effectively.

BALANCED—for smooth running, and to give constantly accurate pressure to the working surface. A smoothly ground face assures uniformity.

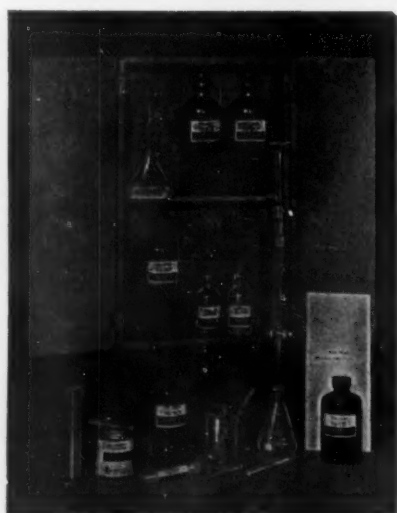
TWO DEGREES OF DENSITY—one offering greater flexibility, the other more aggressive cutting action . . . both giving pliability and resilience beyond standard contact wheels.

WIDE SIZE RANGE—face widths and diameters for most requirements. Wheel equipped with metal hub. Generally most effective when used with Jeans Cloth (J weight) belts.



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Simple test sets for controlling these and other solutions available.

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Specify Kocour Sets from your supplier.

impressions he gained during a visit to England in 1947 when he attended the Third International Conference on Electro-Deposition in London.

The speaker declared that while England can boast of men superb in the technical and research aspects of metal deposition, the production end of the business in Great Britain is pervaded by typical British caution and conservatism which, by a disinclination to attempt new methods, has kept English plating production procedures as well as facilities well behind those found in American plating plants.

The second speaker at the morning session was *Richard O. Hull*, originator of the Hull Cell.

Mr. Hull discussed "*Problems in Chromium Plating and Their Solutions*," which dealt chiefly with methods for conserving chrome and recovering lost chromic acid. He declared that an average of 10 to 20% of the chromic acid bought for the plating job is actually applied in plating, while 80 to 90% is lost through dragout and ventilation loss.

Mr. Hull declared that nearly all chrome plating can be satisfactorily performed with a solution of 45 ounces per gallon of chromic acid.

Charles Russell, a charter member of Los Angeles Branch, regaled the morning meeting with some reminiscences of an oldtime plater.

C. R. Coppersmith, Los Angeles representative of the Aluminum Corporation of America, opened the afternoon business session with a talk on "*Finishing and Electroplating of Aluminum*."

B. C. Case, representing Hanson-Van Winkle-Munning Co., spoke on "*Purification of Plating Solutions*."

Los Angeles Branch was pleased to welcome back as a speaker *B. G. Daw*, head of Lasalco, Inc., St. Louis. Mr. Daw presented an excellent talk on "*Barrel Plating and Ball Burnishing*."

The annual dinner dance was held in the ballroom of the Breakfast Club, beginning at 7:30 p.m.

A splendid list of door prizes, ranging from radios, fog lamps and silverware, to beautifully plated artwork originated in local shops, was contributed by Southern California plating firms and supply houses.

New officers for the 1948-49 term were elected by Los Angeles Branch of the American Electro-Platers' Society at the April 14 meeting. They are: President, *Frank Bunker, L. H. Butcher Co.*

1st vice-president, *Allie Sulzinger, Hughes Aircraft Co.*

2nd vice-president, *John Millhorn, Melford Chemical Co.*

Secretary, *George Kent, Eldred-Kent Laboratories.*

Treasurer, *Roy Lostetter, C. L. Tanner Co.*

Librarian, *Edward George, Ace Plating Co.*

Board of Managers: Chairman, *Howard Woodward; Don Bedwell; and D. N. Eldred.*

Jack Bealle, John Millhorn and Mr. Woodward were named delegates to the national convention at Atlantic City, with *Jack Raskin and R. J. Wooley* as alternates.

Installation of the new officers will take place at the May 12 meeting.

That Los Angeles Branch is making a firm bid for another national membership trophy to add to the two it already has won in past years was attested by the initiation of 18 new members, the largest group to be enrolled since pre-war days.

Inducted by President Woodward were the following:

C. F. Wentworth, Diversey Corp.; R. W. Stevenson, Air-Research Mfg. Co.; Staunton W. Mashburn, Progressive Plating Co.; George W. Hetz, Melford Chemical Co.; Elbert D. Bostrom, Alhambra Plating Industries; Harley Sanders, Naval Shipyard, Long Beach; Frank Virgil, L. H. Butcher Co.; Peter V. Rogers, Oakite Products, Inc.; Edward A. Dripps, Lumidor Mfg. Co.; Robert H. Longacre, Linley Publishing Co.; P. Dobbins, Woods Metal Polishing Co.; Allen Crum, Los Angeles branch manager, American Buff Co.; Anthony Rickman, Atlas Plating Co.; William A. Montana, self; Edward H. Bowlds, Bowlds Engineering Co.; W. T. Lane, Modern Plating Co.; M. Marin, Angeles Plating Co.; and R. Borden, Ocean Side Plating Co.

In behalf of the management of the L. H. Butcher Co., *Jack Raskin*, director of the firm's plating division, invited the branch to hold the June meeting again in the Butcher plant on East Olympic Blvd., Los Angeles as dinner guests of the company. In 1947, 190

PERMAG COMPOUNDS

Used with highest satisfaction
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for metal products

As a cleaning solution in the various types of industrial washing machines, PERMAG Compounds are unequalled for their quick and efficient cleaning qualities and their adaptability to the more difficult cleaning conditions that often arise.

- PERMAG has the chemical and physical requirements of a washing solution.
- —is stable, does not break down.
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Industrial concerns are cordially invited to confer with our Technical Service on metal cleaning. There is no obligation involved for interviews. Write or 'phone us at any time.

PERMAG Compounds are in their
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buffing and polishing compounds?

• If your aim is faster cutting, increased production, greater economy . . . set your sights on Harrison 4-A Products. Our 25 years of experience exclusively with buffing and polishing compounds are your assurance of the right compound for the right metal . . . and of uniform, dependable quality as well. We will be glad to advise you on special problems and furnish samples of compounds that will meet your needs.

**Spray and Dip
Compounds for
Cutting and
Mirror Finish-
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pounds in sizes
150-180-220-240-
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ELECTROPLATERS...

Here's an improved fine silver anode that will insure top quality plating DAY-IN AND DAY-OUT.

APW "Activated" Silver Anodes are manufactured according to an exclusive process developed by APW research and every order is "job-tested" before shipment. They dissolve more cleanly and evenly—do not darken, shed or develop passive spots.

Your saving—cleaner—brighter—better plated products.

Already widely used in the silver plating industry, these "AA" grade anodes are available in any size and quantity for prompt delivery.

Send us your next inquiry and we shall be glad to send you full information and current quotations.

Also
APW Silver
CYANIDE
100 and 1000
ounce drums.

THE AMERICAN PLATINUM WORKS
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**A N A
BRAND**

Buffing and Polishing Compositions Cleaning Compounds

Personal services to each customer a specialty

A. N. AUSTIN CO., Pequabuck, Conn.

members and guests availed themselves of the Butcher Company's hospitality.

The educational program for the April meeting was arranged in the form of a "Quiz Program" during which members were invited to ask questions in an effort to "stump" a panel of experts. The panel was composed of three veteran platers, two chemists and a man versed in the electrical problems of plating shops and their equipment. The panel members were Don Bedwell, Charles Russill, Joseph Sunderhaus, Emmette Holman, D. N. Eldred, and Sidney Hill.

Rochester Branch

The regular Monthly Meeting of the Rochester Branch of the A.E.S. was held at Hotel Seneca, Friday, March 19, 1948. The meeting was called to order by Pres. *Robert Flint*. Due to the amount of business to be transacted, the speaker, *Mr. R. C. Gibson*, of *Parker Rustproofing* was given the floor first.

Mr. Gibson spoke on *Phosphate Coating on Steel, Zinc and Aluminum* and described the preparation and cleaning as well as the Bonderizing. He also showed slides comparing corrosion tests of untreated painted metal against Bonderite coated and painted metal.

Six men were elected to membership: *Frank Beukman, Edward Chizuk, Albert Kelly, Peter Montagiano, Theodore Swenson, and Edwin Wallin.*

Due to pressure of duties concerned with the National Research Group, *Mr. Tucker* resigned as chairman of the Spring Regional Meeting. *Mr. Flint* will take over for *Mr. Tucker*.

The members voted to cooperate with the Buffalo branch concerning a picnic to be held in the late summer. Members also voted to have *Mr. Flint* appoint the delegates for the National Convention.

The election for 1948 officers resulted in the following:

Pres.—*Robert Flint*
Vice Pres.—*Joseph Hull*
Sec.—*James Weaver*
Treas.—*Fred Wagner*
Librarian—*Chas. Hendershott*
2nd Vice Pres.—*Jeff Yorkey*
Board of Managers:—*S. Gartland, F. Daughtery, J. Adams, R. Berghold.*

Melbourne Branch

At the annual election of officers of the Melbourne Branch of the A.E.S. in January, the following officer-bearers were elected: President, *Glen Walker*; First Vice-President, *N. L. Carter*; Second Vice-President, *M. R. J. Andrews*; Librarian, *H. A. Teague*; Board of Managers, *K. Leigh*, *A. Chesterfield*, *J. McOrist*; Secretary & Treasurer, *L. A. L. Francis*.

The first educational meeting of the year, and the 30th regular meeting, was held on the 23rd February, at the Chamber of Manufacturers. Our guest speaker was *Mr. P. F. Thompson*, world authority on the corrosion of metals, and it was fitting that he should speak to us on this important subject.

Mr. Thompson first dealt with the fundamental principles of corrosion, then developed his discussion to cover various types of corrosion, including particularly those characterized by hydrogen evolution and differential aeration.

The importance of insuring that metal surfaces are as smooth as practical was also pointed out, and the dan-

ger of corrosion of metals coated with porous electro-deposits was mentioned.

Numerous original lantern slides were projected; and of great interest was the novel demonstration of corrosion experiments in glass cells which were inserted into the projector in place of ordinary slides. It was thus possible for the whole audience to watch metals being attacked under various conditions, and these practical demonstrations were very popular.

Twin City Branch

The Twin City Branch of the American Electroplater's Society met Monday, April 5th, in the Lodge Room of the Covered Wagon in Minneapolis. There were 39 persons present.

Ray Krieger opened the meeting with the introduction of *Mr. Art Knealing* who is a new member to the Branch. The following guests were welcomed: *Dr. Ralph Andes*, *Brown and Bigelow*, —*Ken Baillargeon* of Superior Plating, —*Dean Keller* of Superior Plating, —*Don Sprague* of Turco, —*Fred Strom* of Reliance Varnish, —*Eldred Cleare* and *Henry Makino* of Minne-

apolis Honeywell, —*Bob Huntley* of National Expert Bait Company, —*Gordon Einberger* of United Chromium, —*Casey McRoberts* of National Pressure Cooker Company.

The door prize for the April Meeting was the choice between a Taylor Stormoguide and a Shakespeare Reel. *Dr. Frank Ireland* won the drawing and chose the fishing reel.

The Fourth Annual Party was announced and members were told that tickets would go on sale at the next meeting. The Party will be held on Monday, June 7th at the Covered Wagon in Minneapolis. *Ralph Maddock* of Pako Corporation and *Hallick Johnson* of Industrial Chemical & Equipment are Co-Chairmen.

Gunnar Deedon of Turco Products, Chairman of the Nominating Committee, announced the Nominations for officers for the coming year. They were: *R. M. Krieger* of Capitol Plating, President, —*Dr. Frank Ireland* of Brown and Bigelow for 1st Vice-President, *Cliff Neuman* of Minneapolis Honeywell for 2nd Vice-President and *Bob Buckley* of Industrial Chemical and Equipment for Secretary-Treasurer.

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REDUCE OPERATING COSTS!

Plating Tank Rheostats.

Various sizes— with and without meters.

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Improved Plating- WITH SARCO

Controlled temperatures mean uniform, high quality plating, day in and out. You can control wash tank temperatures with the Sarco "87" at a cost of a few dollars. Most plating tanks can be controlled with the Sarco "LSI" electric control which costs much less than most methods. For special and highly accurate controls for vapor-line and heating and cooling there are a dozen different Sarco combinations. Four types of Sarco Steam Traps help reduce fuel costs.

SARCO CATALOGS

- No. 1025
LSI Electric Control
- No. 700
TR-40 Cooling Control
- No. 650
Vapor-Line Control
- No. 600
Tank Temperature Controls
- No. 550
87 Trap-Control
- Nos. 350 & 450
Bucket, Thermostatic and Float-Thermostatic Steam Traps
- No. 1200
Pipe Line Strainers

ASK FOR THE SARCO CATALOGS ON PLATING

SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
 Empire State Building, New York 1, N. Y.
SARCO CANADA LTD. TORONTO 5, ONTARIO

Elections will be held at the May Meeting.

Dr. Frank Ireland of Brown and Bigelow, Co-Chairman of the Exhibit Committee for the Convention, announced his Committee's plans for handling the Convention exhibit. He stated that every plating shop will be contacted for a display and it will be arranged and forwarded to the Convention.

Following a short recess, C. A. Bowman of Minneapolis Honeywell, Branch Librarian, introduced Mr. E. W. Relitz of United Chromium who spoke on "Organic Finishes and Protective Coatings."

NATIONAL ASS'N OF METAL FINISHERS

The Annual Meeting of the National Ass'n. of Metal Finishers will be held in Atlantic City on Sunday, June 27th, at the *Atlantic Biltmore Hotel*.

This date precedes by one day the opening of the Convention and Finishing Exposition of the A.E.S., thereby making it convenient for members to attend both affairs.

The Board of Directors meeting will be held in the afternoon of June 27th at 2 p.m., and the dinner meeting will be held in one of the main dining rooms at 7 p.m.

AMERICAN SOCIETY FOR METALS

The New England Regional Meeting of the American Society for Metals will be held in Providence on Friday May 14th. This meeting is sponsored by the Rhode Island, Worcester, New Haven, Boston, Springfield, and Hartford chapters. Headquarters will be at the Hotel Narragansett, and registration will begin at 8:15 a.m. Besides the usual excellent technical sessions, there will be an opportunity to visit several metal-working plants in this area. The Banquet will be held in the evening to conclude the Meeting. A separate program has been arranged for the Ladies, including a trip through the plant of the Gorham Mfg. Co., makers of sterling tableware, and a talk and exhibit of gowns and fashions. Reservations should be made with Mr. A. S. Johnson, *Achorn Steel Co., 227 Washington St., Lakewood, R. I.*

GALVANIZERS MEETING IN ST. LOUIS

Technical and operating men of the galvanizing division of the steel industry will attend a meeting of The Galvanizers Committee to be held on Thursday and Friday, April 15th and 16th, at the *Hotel Staller, St. Louis, Mo.*

On Thursday morning, members of the committee, which is sponsored by the *American Zinc Institute*, will attend the opening session of the Institute's annual meeting scheduled for that day, when subjects of mutual interest are scheduled for discussion.

Among the speakers to be heard on Thursday afternoon is Mr. A. T. Baldwin, of Hanson-Van Winkle-Munning Co., who will talk on the subject of "The Progress of Fluxes in Hot Galvanizing." Mr. S. S. Johnston, of the Weirton Steel Co., and also a Vice President of the *American Electroplaters' Society*, will speak on "Electrolytic Coatings, Tin and Zinc." Round table discussions of operating problems will occupy the rest of the Thursday afternoon session and also the closing session on Friday morning.

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If skin irritations are a problem in your plant let us send you a trial quantity of Tarbonis. In literally hundreds of plants Tarbonis has proved a real help not only in overcoming skin irritations that have occurred, but also in guarding against their recurrence. Pleasant to use—easy to apply—sure of workers' cooperation. Does not interfere with the work to be done. Use the coupon . . . now.

Send for a sample of Tarbonis NOW.



Are These
the Irritants?

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Chrome Dyes
Formaldehyde
Sodium
Bichromates
Lime
Metal Dust
Chemicals
Urea and Phenol
Plastic Compounds
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"Engineering Progress Show in Philadelphia"

The second annual Engineering Progress Show will open on Tuesday, May 11th at the Franklin Institute in Philadelphia. The Show, which is sponsored by the Engineers' Club of Philadelphia—Juniors and the Franklin Institute of Pennsylvania, is to be held in spacious Franklin Hall at 20th and Parkway, Philadelphia. Industrial corporations from all parts of the country will submit to the public their latest advancements in the engineering fields.

In addition to the varied scientific and industrial exhibits, nationally prominent engineers will be present at the evening sessions to speak on subjects of vital interest to members of the engineering profession and to the technically minded public. Mr. E. G. Bailey, National President of the American Society of Mechanical Engineers, Vice President of Babcock & Wilcox and the founder of the Bailey Meter Co., will deliver the opening address Tuesday evening May 11th. Mr. Bailey who is the inventor of the Bailey Feed Regulator, and who is one of the country's outstanding authorities on

steam, power equipment, has previously received the Franklin Institute's Longstreth Medal for outstanding contributions to the Engineering profession.

On Thursday evening May 13th, Mr. T. P. Simpson, Director of Research and Development of the Socony Vacuum Laboratories, will speak. Mr. Simpson is one of the nations leading petroleum engineers.

The Show will open at 12:00 Noon, Tuesday, May 11th, with a brief ceremony at which both national and civic leaders will be present. On May 11, 12, 13 and 14th the Show will open at 12:00 Noon and close at 9:00 P.M.; on Saturday and Sunday until 5:00 P.M. Admission to all will be free.

In the evenings, May 12 and 14th, in addition to Mr. Bailey and Mr. Simpson, other nationally prominent engineers will address the visitors to the show.

ASTM

Report of Committee B-8 on Electrodeposited Metallic Coatings

A very high percentage of attendance by its membership and active participation in meetings of all of its

subcommittees as well as its main committee featured the meeting of Committee B-8 on Electrodeposited Metallic Coatings, held in Washington on March 5 during A.S.T.M. Committee Week.

The Subcommittee on Specifications, Papers and Definitions is currently reviewing all existing tentative specifications of the committee through task groups appointed for each separate specification. The subcommittee also laid plans for participating in the Symposium on Bearing Metals and Their Lubricants which is planned for the June 1949 meeting of the Society.

The Subcommittee on Performance Tests voted to accept in principle a modified rating procedure for copper-nickel-chromium plating on steel based on photographic standards. The subcommittee also voted to cooperate in exposure tests of the American Electroplaters' Society project on the effect of surface finishing of non-ferrous base metals on the protective value of electrodeposited coatings.

The Subcommittee on Performance Tests is currently reviewing the Method of Test for Local Thickness of Electrodeposited Coatings in cooperation

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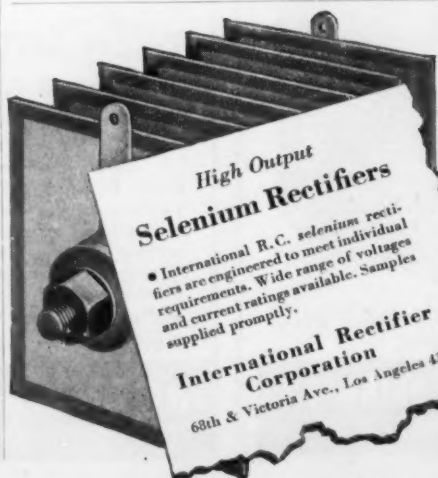
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with Committee A-5 of the Society. Through another group, this subcommittee is studying existing porosity tests to determine their reproducibility. Another group of the subcommittee is studying microhardness and also the applicability of the Jacquet adhesion test. A fourth section of this subcommittee, on luster, has just been organized and is currently reviewing the applicability of various commercially available instruments to measurements of this property.

The Subcommittee on Electroplating Practice has nearly completed a recommended practice for the preparation of high-carbon steel for plating and has organized sections on the preparation for plating of zinc-base alloy die castings, copper and copper alloys, stainless steels, and aluminum.

The Subcommittee on Supplementary Treatments for Plated Coatings appointed groups to survey its field thoroughly.

Officers of Committee B-8 are:

Chairman: C. H. Sample, The International Nickel Co., Inc., New York, N. Y.

Secretary: R. B. Saltonstall, The Udylyte Corp., Detroit, Mich.

NEW BOOKS

Chemistry for the Executive

by Ralph K. Strong

Published by the Reinhold Publishing Corp., 330 W. 42 St., New York, N. Y. Price \$6.00.

This book treats the subject matter in the form of the pupil asking the teacher questions, only here the "pupil" is the executive and "Chemmer" is the obliging "Mr. Anthony." The subject is treated in a non-mathematical and popular manner (inferring, of course, that the average executive either won't or can't wade through this type of a text!). While the method of presentation used in this book became rather tiring to this reader by the time it was finished, there can be no doubt that the material is authoritative and up to date. A very commendable feature is the list of suggested reading included at the end of every chapter for those who wish to delve into that particular subject more deeply. All things considered, the book does an excellent job of covering such a broad field as well as is possible in a single volume, and the relating of theoretical matters with

subjects of present day importance should be very helpful to the reader who has not had too much exposure to the chemical world.

F.C.W.

Theory and Practice of Filtration

Geo. D. Dickey and Chas. L. Bryden.
Published by the Reinhold Publishing Corp., 330 W. 42 St., New York, N. Y. Price \$6.00.

A comprehensive treatise on filtration, both from the theoretical and practical standpoints. Covers all types

of commercially available filtering equipment and the basic reasons for the proper choice of methods and media. This book is very broad in scope and is not restricted to the confines of any one particular field, as it covers gravity filters, pressure filters, vacuum filters, hydraulic and squeeze presses, air, gas, and light filters, centrifugal filters, and several other miscellaneous types.

Recommended for the library of all chemical, process, and plant engineers.
W.A.R.

New Safety Directory Published

The new BEST'S SAFETY DIRECTORY for 1948—covering the entire field of Safety, Fire Protection and Control, Hygiene, First-Aid and Sanitation—is now available to industry, as recently announced by the Alfred M. Best Company, Safety Engineering Division, 75 Fulton St., New York 7, N. Y.

The Directory is unique in that it combines the best practical features of a Safety Manual, Directory, Index, Encyclopedia and Catalog into one comprehensive, profusely illustrated,

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494-page volume. It shows what safety products or devices to use for specific hazards; how to use them; where to get them. Best's was the first Safety Directory published and is still the only one in the field.

The publishers point out that the new book shows a 50% increase over the last edition in actual content. In addition, almost complete editorial changes and rearrangements have been made. While last year's book was enthusiastically received all over the country as filling a long felt need, the 1948 edition is even better.

One outstanding feature of this book is its indexing and subject-grouping system. These devices—plus countless illustrations—make it easy to locate safety products even when the user is not certain of the type or name of the product he needs. The logical arrangement of subjects also serves as a check-list of hazards—many of which are frequently overlooked. Typical sections are *Arm and Hand, Body and Leg, Eye and Face, Fire*, etc.

The book is priced at \$5.00—with

lower rates for quantities. Either the Directory itself or complete information may be obtained from the above firm.

Electroplating on Aluminum and Its Alloys

by T. A. Hood Munitions Supply Laboratories Information Circular 10 Maribyrnong, Victoria, Australia.

This is a comprehensive compilation of references on plating of aluminum alloys, covering articles that have appeared in trade and technical papers as well as patents issued in this field. Eighty-two references are cited, followed by abstracts containing the important details of each reference. Both foreign and American technical journals are referred to.

Precision Investment Castings

by E. L. Cady Reinhold Pub. Co., 330 W. 42 St., N. Y. C. Price \$6.00.

A textbook covering the entire field of precision casting by the investment

casting process. A considerable portion of this book is concerned with the economics involved in the choice of casting methods and the design for maximum efficiency. Various types of alloys are discussed: methods of casting, dimensional control, patterns, types of molds, and equipment are also covered.

Aluminum and Aluminum Alloys in the Food Industry

by J. M. Bryan. Food Investigation Special Report No. 50 Dept. of Scientific and Industrial Research Park House 24 Rutland Gate, London SW7. Price 3 shillings.

This report covers a comprehensive study of the use of aluminum and its alloys in the food industry, with special emphasis on the effects of corrosion by foods, and the methods available to protect the metal from these corrosive attacks. Corrosion rates and data are given for a large number of food products and aqueous solutions. Various chemical and electrochemical finishing methods are described that can be used to overcome some of problems involved.

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Letters to the Editor

Metal Finishing,

11 West 42nd St.,
New York 18, N. Y.

Editor:

Dear Sir:

In the March issue, page 85, under "Shop Problems", headed "Chrome Plating Cast Iron", we have obtained excellent results by employing the following sequence:

1. Dip or spray in Emulsion cleaner
2. Warm water dip and spray
3. Alkaline soak cleaner
4. Warm water rinse
5. Electrolytic alkaline cleaner (anodic)
6. Warm water rinse

7. Cold water rinse
8. Immerse in 5% by volume Hydrofluoric Acid
9. Cold water rinse—cold water rinse
10. Cyanide copper strike—until the surface is entirely covered
11. Cold water rinse
12. Bright copper plate
13. Color buff

The above is most important in securing a sound foundation for subsequent nickel and chrome plating.

"Passive" nickel plate is best "depasivated", by employing an 8 oz./gal. solution of sodium cyanide. The work is treated cathodically until a vigorous evolution of gas is observed.

I sincerely hope this bit of additional information will prove helpful.

Very truly yours,
S. G.

Correction

In the article on "Modern Mechanical Surface Finishes" by Martin Manner which appeared in *Metal Finishing*, December 1947, the author neglected to include under Ref. # 17 the Catalogue # 10 of the A. P. Munning Co., page 121 (1923-1924).

Both the author and Metal Finishing regret this omission, and are glad to have this called to our attention.

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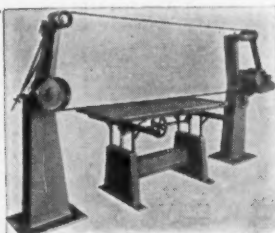
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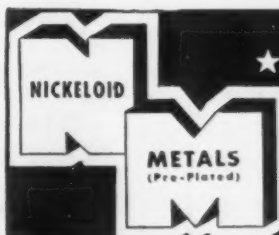
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